Big Willow Creek Watershed (17050122SW17)

Total Maximum Daily Load

Implementation Plan for Agriculture

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Introduction

A final draft of the Big Willow Creek Assessment and Temperature Total Maximum Daily Load (TMDL): Addendum to the Lower Payette SBA-TMDL was prepared by the Idaho Department of Environmental Quality (IDEQ) on May 2008 and approved by the Environmental Protection Agency (EPA) on July 2008. The Soil & Water Conservation Commission (SWC) is responsible for preparing the implementation plan for agriculture.

PURPOSE

The Big Willow Creek (TMDL) Implementation Plan for Agriculture outlines an adaptive management approach for implementation of best management practices (BMPs) and resource management systems (RMS) on agricultural lands to meet the requirements of the Big Willow Creek Assessment and Temperature TMDL: Addendum to the Lower Payette River Subbasin Assessment (SBA) and TMDL. An adaptive management approach allows for modification of resource management decisions based on experimentation.

GOALS AND OBJECTIVES

The goal of this plan is to provide a strategy for agriculture to assist and/or complement other watershed efforts in restoring and protecting beneficial uses for water quality impaired streams in the Big Willow Creek watershed (Figure 1). The DEQ identifies water quality impaired streams in an integrated report compiled every two years and in Subbasin Assessments and TMDLs. Table 1 separates Big Willow Creek into assessment units and their corresponding listed pollutants from the SBA-TMDL (Table 1, Figure 2).

Table 1. Assessment Units in the Big Willow Creek watershed (IDEQ 2008).

Assessment Unit #	*Listed Pollutants and Source of Use Impairment*
ID17050122SW17_02 (1st and 2nd order)	Temperature, Flow Alteration, Habitat Modification, Unknown
ID17050122SW17_03 (3rd order)	Temperature, Flow Alteration, Habitat Modification, Unknown
ID17050122SW17_04 (4th order)	Temperature, Flow Alteration, Habitat Modification, Unknown
ID17050122SW17_06 (6th order)	Temperature, Flow Alteration, Habitat Modification, Unknown

The Big Willow Creek watershed falls within small portions of Gem and Washington counties, but it is primarily within Payette County. These counties are served by the Gem Soil and Water Conservation District (SWCD), Weiser River Soil Conservation District (SCD), and the Payette SWCD. The objective of this plan is to provide guidance to the districts, partnering agencies, such as the Natural Resource Conservation Service (NRCS), and agricultural producers concerning ways to reduce pollutant loading to listed waterbodies. Agricultural pollutant reductions will be achieved by on-farm conservation planning with individual operators and application of BMPs in agricultural critical areas. This plan recommends BMPs to meet TMDL targets in the Big Willow Creek watershed

and suggests alternatives for reducing surface and groundwater quality problems from agricultural related activities.

Background

PROJECT SETTING

The Big Willow Creek watershed is located within the Lower Payette River Subbasin in southwestern Idaho (Figure 1). At approximately 2,300 feet in elevation, Big Willow Creek drains into the Payette Ditch which flows southwestwardly into the Payette River, towards the cities of Fruitland, New Plymouth, and Payette. The highest elevation is near the base of Willow Ridge at approximately 4,800 feet. The Payette River Scenic byway (HWY 55) bounds the Big Willow Creek watershed to the east and the Snake River lies to the west. The Weiser River subbasin is located north of Big Willow Creek. As stated in the Big Willow Creek Assessment and Temperature TMDL, "Climate is typical of semi-arid and unwooded alkaline foothills with most precipitation occurring November through February with occasional intense storms in the summer months." Average annual precipitation ranges from less than 14 inches at the southern end of the watershed to 30 inches at the northern end of the watershed. Soils are well-drained clay, sand, or silt loams. For more information regarding the climate, hydrology, soils, vegetation, and other watershed characteristics; please consult the Big Willow Creek Assessment and TMDL (IDEQ 2008). The entire watershed (143,675 acres) is in the Owyhee Uplands Section of Baileys Ecoregions (http://data.insideidaho.org).

The Big Willow Creek watershed is comprised of three Common Resource Areas (CRAs). General characteristics for these CRAs are described below (ftp://ftpfc.sc.egov.usda.gov/ID/technical/pdffiles/IdahoCRAReport.pdf.).

10.4 Central Rocky and Blue Mountain Foothills and Semiarid Foothills- mean annual temperature between 8 and 15 °C; fine textured soils of lacustrine deposits; moderate amounts of precipitation in fall, winter, and spring but low precipitation during the summer; natural plant community of shrubs and grasses, may also include cheatgrass; high wildfire frequency; livestock grazing

11.1 Snake River Plains – Treasure Valley- mean annual temperature <8 °C or between 8 and 15 °C; moist winters and dry summers; natural plant community of sagebrush steppe shrubs and grasses, such as sagebrush, shadescale, rice grass, blue grass, and needle and thread grass; cultivated land includes irrigated cropland and pastureland; cities, suburbs, and industries; surface water alterations by canals, reservoirs, and diversions for irrigation, urban, and industrial uses; crops include wheat, barley, alfalfa, sugar beets, potatoes, and beans.

11.7 Snake River Plains – Dry- mean annual temperature <8 °C or between 8 and 15 °C; unwooded alkaline foothills; lacustrine terrace deposits; shallow and moderately deep soils over cemented pans are common; moist winters and dry summers; natural plant community of saltbush, greasewood, and other sagebrush steppe shrubs and grasses, may also include cheatgrass and crested wheatgrass

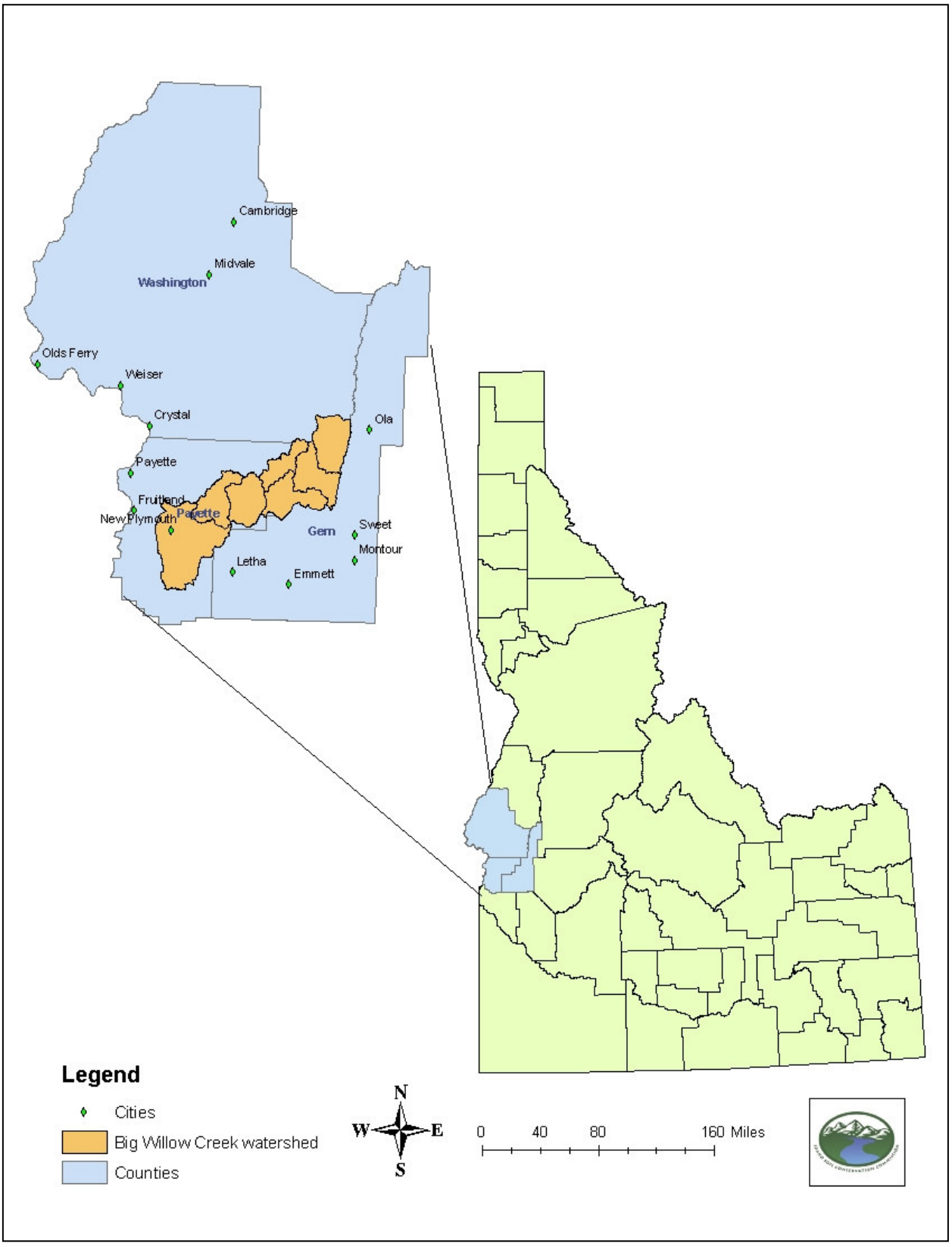


Figure 1. General Location of the Big Willow Creek watershed

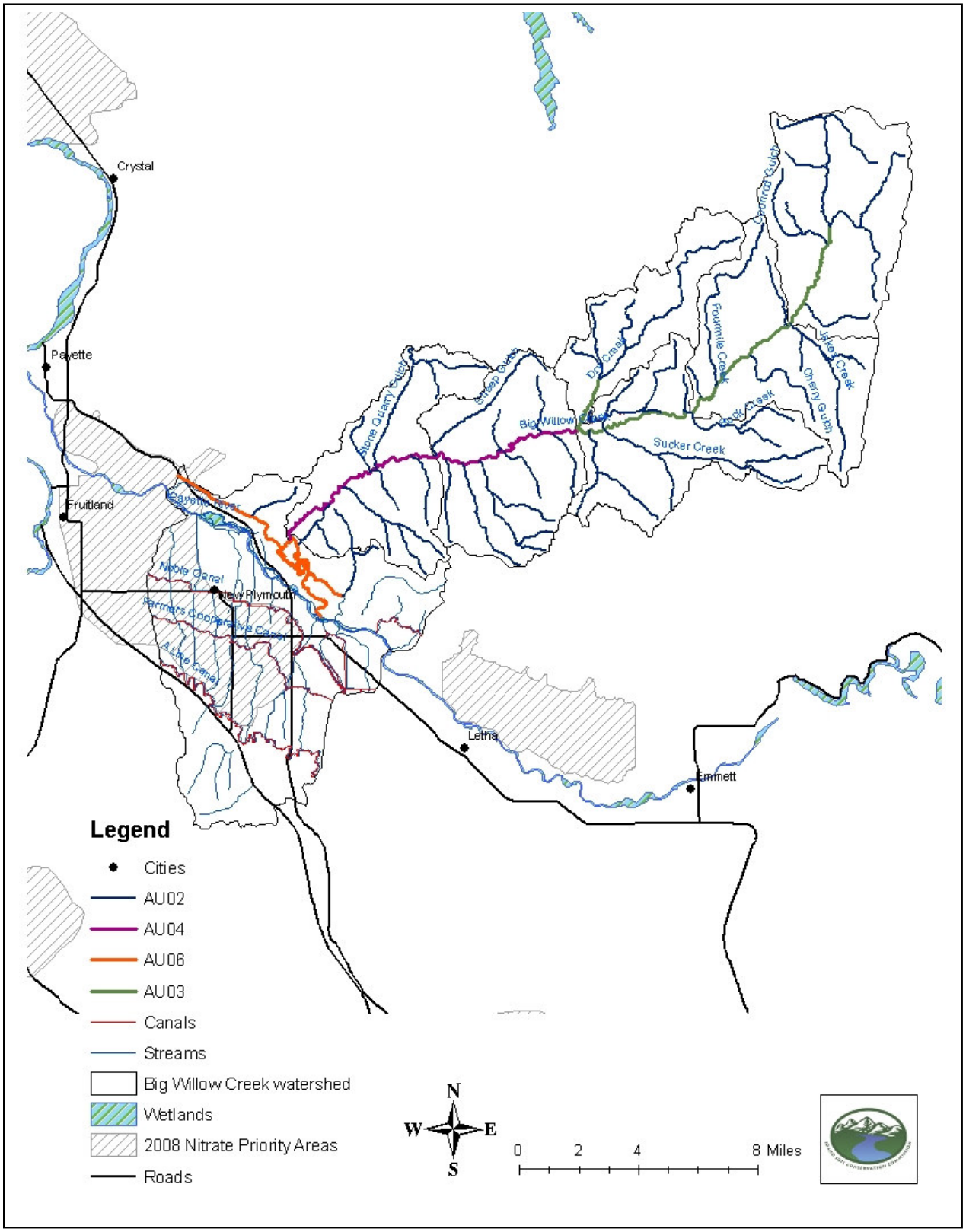


Figure 2. Assessment Units in the Big Willow Creek watershed

LAND USE

Rangeland is the predominant land use in the Big Willow Creek watershed. With the exception of irrigated grass/pasture/hayland and irrigated cropland south of the Payette River, most of the native vegetation is typical of a sagebrush steppe community. A series of canals known as Noble, Farmers Cooperative, A-Line, and Payette Irrigation Canal are used to irrigate private land near the city of New Plymouth in the southern portion of the watershed. Forestland is concentrated in the draws above the confluence of Fourmile Creek and Big Willow Creek and also near Squaw Butte. Major highways (HWY 52, 84, and 95) intersect the southern portion of the watershed and are located near the Payette River. Dirt roads are scattered throughout the watershed and located near Big Willow Creek (Table 2, Figure 3).

Table 2. Land use in the Big Willow Creek watershed.

Land Use Category	*Acres*	*% of Watershed*
Shrub/Rangeland	96,468	67.1
Grass/Pasture/Hay	27,348	19.0
Grain Crop	9,150	6.4
Row Crop	6,425	4.5
Forest	2,288	1.6
Water/Wetlands	1,996	1.4
TOTAL:	143,675	100

LAND OWNERSHIP

Land ownership in the watershed is mostly private. Bureau of Land Management (BLM) and other state agencies mange the remaining lands. Table 3 describes the type of land owner or land manager, the total acres, and the percent of watershed in use by each of the above land owners/managers. Figure 4 displays land ownership/management on a map of the Big Willow Creek watershed.

Table 3. Land ownership in the Big Willow Creek watershed.

Land owner/manager	*Acres*	*% of Watershed*
Private	75,560.4	52.6
BLM	60,015.9	41.8
State	7,591.6	5.3
IDFG	508.5	0.4
TOTAL	143,676.4	100

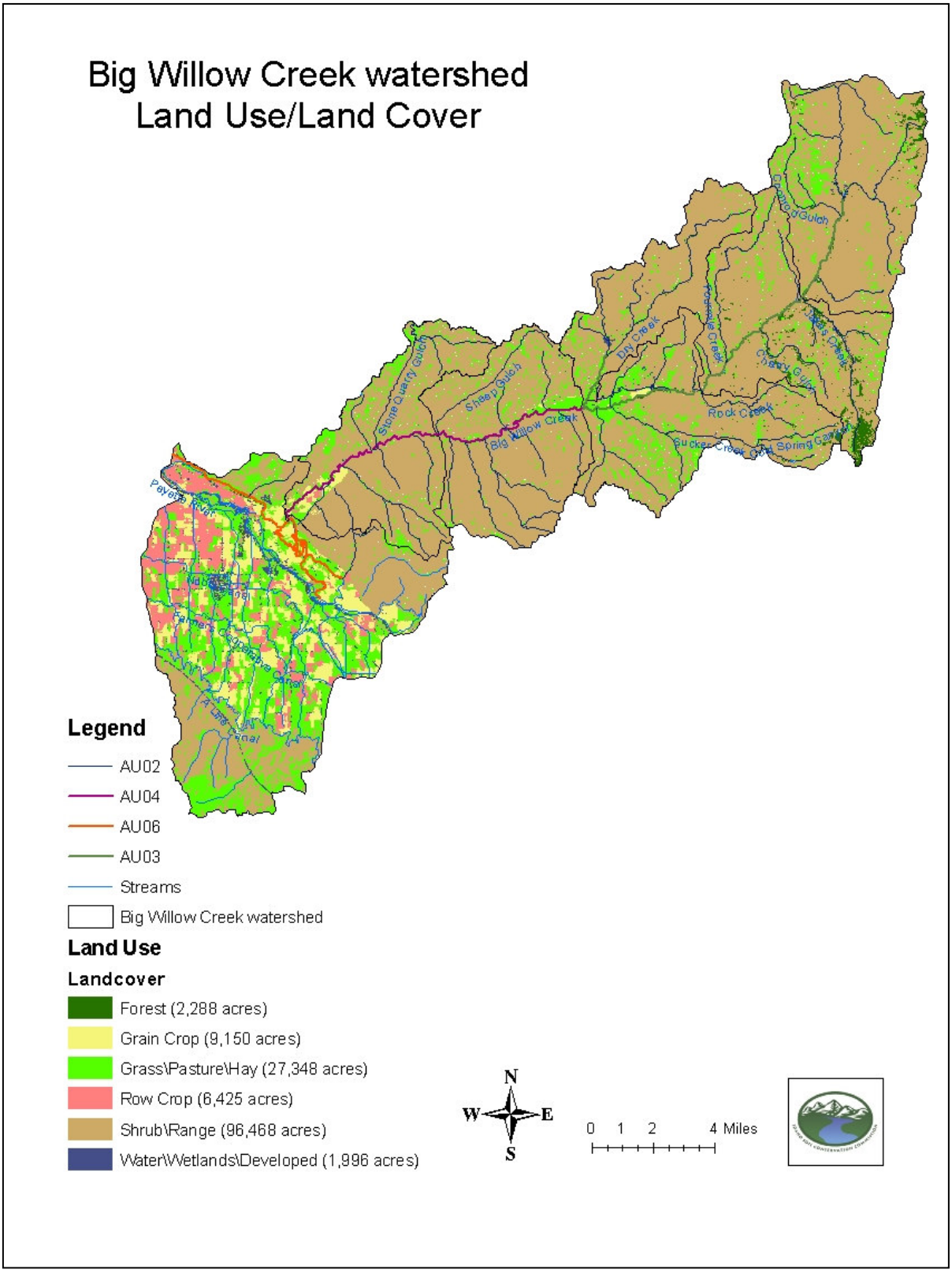


Figure 3. Land Use/Land Cover in the Big Willow Creek watershed

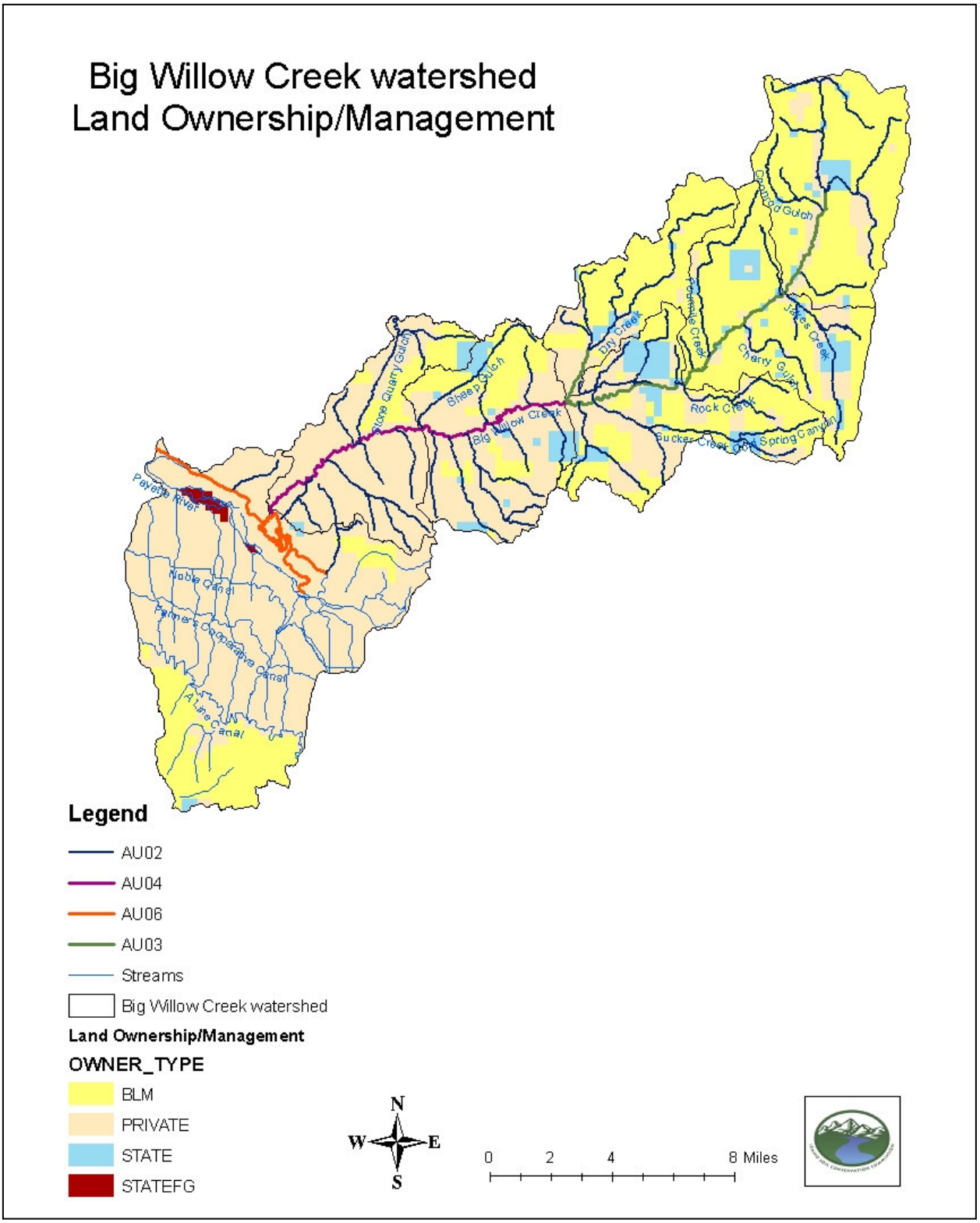


Figure 4. Land Ownership/Management in the Big Willow Creek watershed

CONSERVATION ACCOMPLISHMENTS

Most of the past practices installed on cropland and hayland have focused on improving water efficiency through irrigation conversions or improvements as well as management practices such as irrigation water, nutrient, and pest management. Practices installed on rangeland and pasture land were associated with cattle grazing requirements, such as fencing, watering facilities, and plantings. Prescribed grazing and irrigation practices were also installed on pasture land. Very few practices were installed on forested lands because the watershed contains few forested lands. The majority of BMPs installed were located in the southern portion of this watershed because cropland, hayland, and pastureland are heavily concentrated near the Payette Ditch and south of the Payette River (Figure 5). Although this implementation plan will only consider the land north of the Payette River; a summary of the best management practices (BMPs) installed throughout the watershed through federal programs from fiscal years 2004 through 2010 can be found in Table 4 (http://ias.sc.egov.usda.gov/PRSHOME).

The aim of BMPs outlined in this plan is to reduce impacts to water quality from agricultural lands. In the Big Willow Creek watershed BMPs have typically been funded through local SWCD/SCDs and NRCS Farm Bill Programs such as the Conservation Reserve Program (CRP), Environmental Quality Incentives Program (EQIP), Grazing Lands Conservation Initiative (GLCI), Ground and Surface Water Conservation (GSWC), and Wildlife Habitat Incentives Program (WHIP). For more detailed information regarding these programs please refer to the funding section of this plan.

Table 4. Completed Federal BMPs in the Big Willow Creek watershed, by year.

Practice Applied	Practice Number	Unit	2010	2009	2008	2007	2006	2005	2004	TOTAL
Above Ground MultiOutlet Pipe	431	ft	1,544.0	4830.0	1,710.0					8,084
Access Control	472	ac							1	1
Anionic Polyacrylamide (PAM) Erosion Control	450	ac			71.4		208.3	17.9	36.3	334
Comprehensive Nutrient Management Plan	100	no			1.0		2.0	1		4
Conservation Cover	327	ac				37.8	18.0			56
Conservation Completion Incentive	CCIA	no			2.0					2
Conservation Crop Rotation	328	ac			253.1		368.8	101	180	903
Deep Tillage		ac						28.5		29
Diversion	362	ft			2,900.0					2,900
Fence	382	ft	6,520.0	1606.0	15,586.0	68,524.0	8,018.0	12,792	3,009	116,055
Filter Strip	393	ac							31	31
Forage and Biomass Planting	512	ac	2.4							2
Forage Harvest Management	511	ac			344.2	256.1			3.5	604
Forest Slash Treatment	384	ac			20.0					20
Forest Stand Improvement	666	ac			29.6					30
Heavy Use Area Protection	561	ac			0.3				0.2	1
Irrigation Land Levelling	464	ac		49.0			72.7	15	72	209
Irrigation System, MicroIrrigation	441	ac			19.0					19
Irrigation System Sprinkler	442	ac		37.0	1,171.8	73.5	233.5	38.5		1,554
Irrigation System, Surface & Subsurface	443	ac	183.3		50.5	80.0	46.6	72	89.8	522
Irrigation Water Conveyance, Corrugated Metal Pipeline	780	ft	20.0	150.0	60.0					230
Irrigation Water Conveyance, Ditch and canal lining	428A	ft	491.0	728.0	3,380.0	13,498.0	3,408.0	1465	145.7	23,116
Irrigation Water Conveyance, Pipeline, High-Pressure, Underground, Plastic	430dd	ft		8113.0	42,150.7	1,505.0		1120		52,889
Irrigation Water Conveyance, Pipeline, Low Pressure, Underground, Plastic	430ee	ft			3,615.0	6,232.0	6,144.0	4,480	10	20,481
Irrigation Water Conveyance, Pipeline, Steel	430ff	ft			46.0	6.0	88.0	40	61.6	242
Irrigation Water Conveyance, Rigid Gated Pipeline	430hh	ft						1,080		1,080
Irrigation Water Management	449	ac		111.2	744.9	57.0	571.8	271.9	1239.1	2,996
Land Smoothing	466	ac				2.0		8		10
Mulching	484	ac			84.3					84
Nutrient Management	590	ac	71.5	213.9	432.3	36.5	220.5	559.6	1504.2	3,039
Pasture and Hay Planting	512	ac			96.0		12.1	21		129
Pest Management	595	ac	5.7	512.9	4,317.1	2,075.1	1,527.3		548.5	8,987
Pipeline	516	ft			230.0	3,970.0		40,345		44,545
Pond	378	no			1.0	1.0				2
Prescribed Grazing	528	ac	16.5	5153.2	2,440.1	5,769.1	42.0	113.2	2838.9	16,373
Pumping Plant	533	no		2.0	10.0	6.0	1.0	1		20
Range Planting	550	ac						59		59
Riparian Herbaceous Cover	390	ac				233.9				234
Sediment Basin	350	no		1.0				2		3
Spring Development	574	no			2.0					2
Streambank and Shoreline Protection	580	ac			55.0					55
Structure for Water Control	587	no	4.0	7.0	27.0	5.0	6.0	8	4	61
Tree and Shrub Establishment	612	ac			17.3					17
Tree and Shrub Site Preparation	490	ac			5.0					5
Upland Wildlife Habitat Management	645	ac	5.7	5512.3	2,556.4	6,559.0	171.2	113.9	79.8	14,998
Use Exclusion	472	ac			210.6	286.6	52.0	42		591
Waste Storage Facility	313	no			1.0					1
Waste Utilization	633	ac							92.1	92
Watering Facility	614	no		1.0	1.0	1.0		9		12
Wetland Enhancement	659	ac				86.9				87
Wetland Restoration	657	ac			8.0					8
Wetland Wildlife Habitat Management	644	ac				86.9			1	88

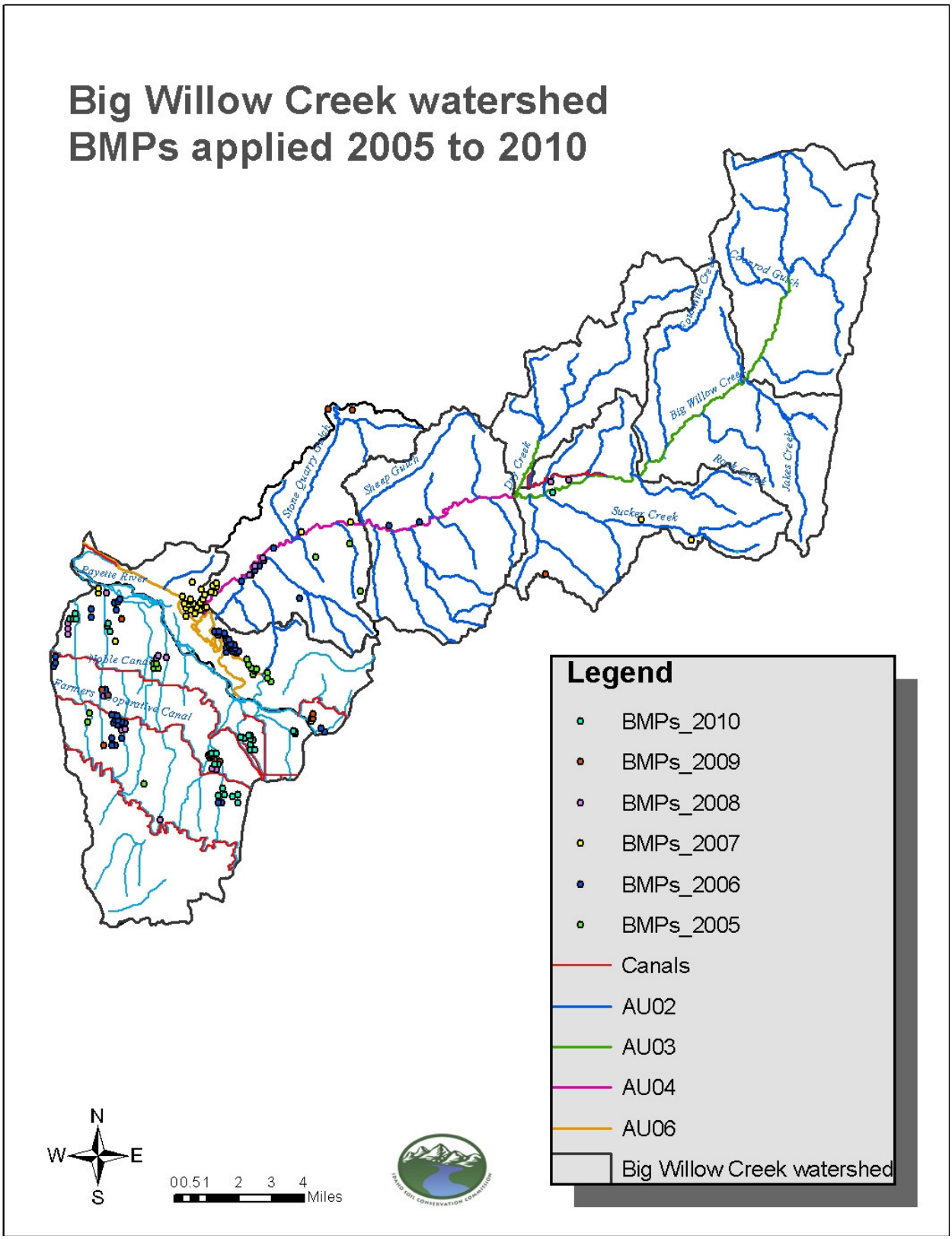


Figure 5. Federal BMPs implemented in the Big Willow Creek watershed, by year

Water Quality Problems

BENEFICIAL USE STATUS

Idaho water quality standards require that beneficial uses of all water bodies be protected. Beneficial uses can include existing uses, designated uses, and presumed existing uses. Designated uses are uses officially recognized by the state. In cases where designated uses have not been established by the state for a given water body, DEQ has established the presumed existing uses of supporting cold water aquatic life and either primary or secondary contact recreation. Designated beneficial uses for assessment units in the Big Willow Creek watershed are listed below in Table 5 (IDEQ 2008). In order for beneficial uses to be supported, water quality criteria must not be exceeded. Some of these criteria are:

- Cold water aquatic life-<22° C daily maximum or <19° C daily average
- Primary Contact Recreation (PCR)-< 126 *E.coli*/100 ml (geometric mean) or <406 *E.coli*/100 ml (instantaneous)
- Salmonid Spawning (SS)-<13° C daily maximum or <9° C daily average (during rainbow trout and bull trout spawning and incubation periods)

Based on fish, habitat, and macroinvertebrate data collected by IDEQ, cold water aquatic life is not a supported beneficial use for Big Willow Creek. Salmonid spawning is a designated use for Big Willow Creek as shown in Table 7 of the SBA-TMDL. The Big Willow Creek SBA-TMDL states that "salmonid spawning is an existing use for AU#03, as documented by the presence of young of the year [fish less than one year old] salmonid species [brown trout, rainbow trout, whitefish, etc.]." This beneficial use is not supporting for AU#03 based on recent fish data that falls below threshold limits. In 2002, AU #03 fully supported all of its beneficial uses. Primary contact recreation is supported in AU#03. The support status for salmonid spawning has not been assessed for AU # 02, 04, or #06. The SBA-TMDL recommended that assessment units #02, #04, and #06 remain listed as impaired for unknown pollutants until further data can be collected and assessed to determine the support status for the primary contact recreation beneficial use. The 2008 Integrated Report has the status of primary contact recreation as fully supporting for all assessment units, except AU#06 which is not assessed.

BURP data collected by IDEQ (IDEQ 2008) suggests that flow modification and habitat alteration play a role in this creek not meeting the cold water aquatic life beneficial use. According to Table 17 in the SBA-TMDL, assessment units #02, 03, 04, and 06 are considered flow and habitat altered, therefore they were recommended to be placed in section 4c (not impaired by a pollutant). AU #02, #04, and #06 will remain in section 5 for unknown pollutants because the primary contact recreation beneficial use is not met.

Table 5. Beneficial uses for assessment units in the Big Willow Creek watershed (IDEQ 2008).

Assessment Unit #	*Waterbody*	*Boundaries*	*Beneficial Uses*	*Support Status*
17050122SW017_02	Big Willow Creek	1st and 2nd order	CWAL PCR SS	Not Supporting Not Assessed Not Supporting
17050122SW017_03	Big Willow Creek and Dry Creek	Rock Creek to Payette River	CWAL PCR SS	Not Supporting Fully Supporting Not Supporting
17050122SW017_04	Big Willow Creek	4th order	CWAL PCR SS	Not Supporting Not Assessed Not Supporting
17050122SW017_06	Big Willow Creek	6th order	CWAL PCR SS	Not Supporting Not Assessed Not Supporting

CWAL=Cold Water Aquatic Life, PCR=Primary Contact Recreation, SS=Salmonid Spawning

POLLUTANTS

Big Willow Creek, from the headwaters to the mouth, was originally listed on the 1998 303(d) list for unknown pollutants. Temperature was added as a pollutant for this watershed by EPA. The 2002 Integrated Report lists the 1st,2nd, 4th, and 6th order segments of Big Willow Creek as impaired by unknown pollutants. The 3rd order segment of Big Willow Creek was not assessed at this time. A temperature TMDL was completed for all four assessment units in May 2008. The 2008 Integrated Report still lists the 1st, 2nd, and 4th order segments of Big Willow Creek as impaired by temperature, although these assessments will be moved to section 4a (TMDL completed). Sedimentation/siltation is listed as a concern for the 4th order segment. The 6th order segment is impaired, according to BURP biota/habitat assessments, but the cause is unknown.

IDEQ calculated temperature load allocations and reductions required to meet TMDLs for Big Willow Creek based on Potential Natural Vegetation (PNV). Field verification of these calculated existing loads using solar pathfinder technology improves their accuracy. According to the SBA-TMDL, assessment unit # ID17050122SW17_04, Big Willow Creek between the Payette Ditch and Dry Creek, has the greatest excess solar load. This stretch of Big Willow Creek, in particular the area near Four Corners, also requires some of the greatest reductions necessary to meet TMDL. Only temperature excess loads and required load reductions are shown in Table 6 because further data collection is required to clarify the unknown pollutant status for these assessment units. In addition, tributaries of Big Willow Creek may also contribute loading to Big Willow Creek, however, they have not been assessed at this time.

Table 6. [2002] 303(d) listed stream segments: identified pollutants and required reductions.

Assessment Unit #	*TMDL Developed*	*Excess Load (kWh/day)*	*Percent Reduction Required to meet TMDL*	*Agricultural Concerns*
ID17050122SW17_02	Temperature	1,550	1 to 21	streambank instability due to cattle grazing
ID17050122SW17_03	Temperature	51,252	0 to 35	streambank erosion from livestock grazing; recreational use
ID17050122SW17_04	Temperature	441,908	0 to 30	low flow conditions and dewatering from diversions; pastureland adjacent to creek; streambank erosion from livestock grazing; ATV use
ID17050122SW17_06	Temperature	215,373	5 to 25	regulated as an irrigation canal; low flow conditions and dewatering; stream channel modification

WATER QUALITY MONITORING

Water quality monitoring data discussed in the Big Willow Creek Assessment and Temperature TMDL: Addendum to the Lower Payette River Subbasin Assessment and TMDL was primarily from the DEQ Beneficial Use Reconnaissance Program (BURP). BURP sites were located near the confluence of Big Willow Creek and the Payette Ditch and at the confluence of Big Willow Creek and several other tributaries, including Dry Creek, Sucker Creek, Rock Creek, Fourmile Creek, and Jakes Creek. A summary of these data were discussed under the Beneficial Use Status section of this plan. Bacteria data still needs to be collected from AU #02, #04, and #06 in order to determine if the primary contact recreation beneficial use is being met. Further data collection and analysis is also needed to describe the pollutant responsible for their impaired listing.

The ISDA collected water quality data (total phosphorus, dissolved phosphorus, suspended sediment, and bacteria) from April through October 2007 (Campbell 2008). Based on data from three sample sites (BWC-1 near Bluff road, BWC-2 near Sucker Creek road, and BWC-3 near Big Flat Road and Fourmile Creek), dissolved phosphorus

is the predominant form of phosphorus in Big Willow Creek. Two out of the three sample sites would require approximately fifty percent reduction in phosphorus to meet the target of 0.07 mg/L (Campbell 2008). Nuisance aquatic growth was observed during monitoring. The source of the excess phosphorus is unknown (personal communication Kirk Campbell). Low dissolved oxygen levels at BWC-1 and BWC-2 may be correlated with excessive aquatic plant growth linked to high phosphorus levels. Suspended sediment concentrations did not exceed the sediment target of 25 to 100 mg/L. Bacteria samples showed exceedances of the instantaneous bacteria target of 406 CFUs at the BWC-1 and BWC-2 sites (Campbell 2008).

AGRICULTURAL WATER QUALITY INVENTORY AND EVALUATION

The following information is based on the Soil Survey of Payette County, Idaho (Rasmussen 1976); personal communication with Mike Raymond (NRCS District Conservationist); the Payette RWA (NRCS 2007) and conservation system guides for Payette County (https://csg.sc.egov.usda.gov/CSGReporteFOTG.aspx).

Cropland

Cropland is a very minor land use in the Big Willow Creek watershed, north of the Payette River. Conventionally tilled, cultivated cropland is found on 0-7% slopes. Elevation ranges from 2,200 to 2,700 feet. Precipitation is 9 to12 inches per year. Frost free season is 120 to 160 days. Irrigated crops are grown on Greenleaf, Haw, and Moulton soils. Soils are typically sandy loams, silt loams, and gravelly loams. Practices such as land leveling and land smoothing have been applied to this land use. Irrigation is split between sprinkler and flood. Flood irrigation is via earthen and concrete ditches. There are some hand-lines, wheel-lines, and pivots used to irrigate crops. Runoff potential is low. Although sprinkler-irrigation induced erosion may be a concern, especially on steeper slopes. The irrigation water source is surface water from Big Willow Creek and the Payette Slough. Typical crops grown include silage corn, grain corn, small grains, and alfalfa. Grazing of crop aftermath is common. Fertilizers and pesticides are typically applied.

Grass/Pasture/Hayland

Irrigated pastureland includes both low elevation pastures and high elevation pastures. Elevation ranges from 2,200 feet in the bottomlands along streams to 3,000 feet in the uplands. Precipitation is 8 to 16 inches per year with a growing season ranging from 80 to 160 days. Typical soils are silt loams or sandy loams. Irrigated pastures are often surface irrigated by earthen or concrete ditches, with tailwater eventually returning to rivers or streams. Irrigation efficiency is 20-35%, but this may be increased to 70% or greater with conversion to hand line, wheel line, or pivot sprinkler systems. Approximately five percent of the pastureland in the watershed is sprinkler irrigated. Big Willow Creek and the Payette River supply much of the water used to irrigate pastures.

Practices such as land leveling and land smoothing have been applied to a small number of pasture and hay fields. Pastureland consists of introduced forage species and native perennials whereas hayland consists of a small grains and an alfalfa rotation. The average rotation may be 10 years of pasture followed by 2 years of small grains.

Fertilizers and pesticides may be applied. Irrigated pasture is grazed throughout the growing season. Pastureland adjacent to riparian areas may be negatively impacted by livestock. Pasture condition score sheets were completed for the lower end of Big Willow Creek by NRCS staff in 2007. These score sheets are based on ten indicators that evaluate percent desirable plants, plant cover, plant diversity, plant residue, plant vigor, percent legume, uniformity of use, livestock concentration areas, soil compaction, and erosion. Overall pasture condition score was good, requiring only minor changes (proper irrigation management) to enhance plant productivity.

Rangeland

Rangeland spans from low elevation (2,300 feet) semi-desert to high elevation (>3,000 feet), steep terraces. As stated in the Payette county soil survey, "the native range is badly depleted or gone." At lower elevations, rangeland is mostly introduced annual species, such as medusahead rye, bulbous bluegrass, and cheatgrass. A few native bunchgrasses, such as squirrel tail and basin wild rye, are known to occur. Reseeding with Siberian wheatgrass, Russian wildrye, tall wheatgrass, yellow sweetclover, and saltbush was attempted near French Quarter, but failed. Range sites are classified in disturbance state 3 because annual introduced species out-compete native plants. Low precipitation exacerbates the problem. The Big Willow Creek watershed is in the intermountain semi-desert ecoregion which was historically characterized by bitterbrush, sagebrush, and perennial bunchgrasses. Fires have eliminated some of the native sagebrush steppe, thereby allowing cheatgrass and other invasive species to succeed. At higher elevations, rangeland condition improves and native reseeding may be possible. Some trees have been planted for wildlife habitat.

Low elevation rangeland has precipitation ranging from 8-12 inches per year. Mid-elevation rangeland, on terraces, benches, and rolling hills has precipitation ranging from 12-16 inches per year. High elevation rangeland found on steep slopes and high mountain valleys has precipitation greater than 16 inches. Frost free season is 100 to 160 days, but this may be less depending on the elevation. The erosion hazard is slight to moderate to rapid depending on the slope. Slopes are typically 3 to 12%, but they can be 30-65% in the steep terraces or slopes. Some of the soils typical of rangeland include Cashmere sandy loam, Haw loam, Lanktree-Haw complex, Payette Van Dusen, and Power-Elijah silt loam. Watering facilities are generally needed to provide water for livestock. Rangeland is grazed in the late winter and early spring during green up and then livestock are moved to higher pastures in the summer months. Livestock have access to the riparian corridor and Big Willow Creek with the exception of a small section of land, at the lower end of the watershed, which is in CCRP.

In 2002 and 2007, NRCS staff used a similarity index to rate range condition for the lower end of Big Willow Creek. A similarity index can be used to compare the current plant community to a desired plant community. Overall scores were around ten indicating poor condition with ninety percent undesirable species. Most of the assessed rangeland is in poor condition, with only isolated areas representing fair and good condition sites. Livestock forage and prescribed grazing schedules have been completed for portions of the rangeland.

Riparian

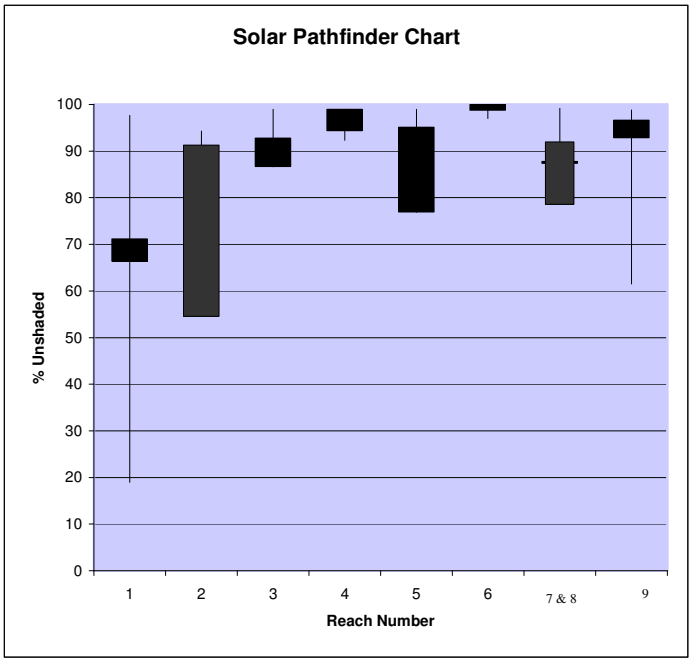
Solar Pathfinder (SP)

Estimates of existing and potential solar loads were generated by DEQ. Field verification of these estimates is performed using a solar pathfinder. A solar pathfinder is used to determine the amount of shade received at a particular point based on canopy cover, topography, aspect, and so on. The following solar pathfinder data was collected by SWC personnel in the summer of 2009.

The protocol used by SWC staff was similar to the protocol described in the Big Willow Creek SBA-TMDL. A reach was started at a known location, such as a bridge, cattle crossing, property boundary, etc. and then data points were taken at fixed intervals occurring 100 feet between readings and 300 feet between sets of readings so as to obtain a systematic distribution across the reach. Typically nine to fifteen points were taken per reach. As shown in Table 7, average data set values are approximately equal to the standard deviation values demonstrating a wide range of values. In the solar pathfinder chart, greater percent shade (lower % unshaded on the x-axis) occurred at the lower end of the watershed (reaches 1, 5, and 2) while the remaining reaches (3, 4, and 6) had greater % unshaded. The last two reaches (7 & 8 and 9) had more shade than the middle portion of the stream. Overall shade on this portion of Big Willow Creek was patchy. In most reaches, maximum values were less than 45% shade.

Table 7. Solar pathfinder results for AU #04 in the Big Willow Creek watershed

	% Existing Shade				
Reach	Six month average	Data set average	Min	Max	Standard Deviation
Big Willow Creek Reach 1	27.7	25.4	1	92	31
Big Willow Creek Reach 2	9.8	4.4	0	12	3.8
Big Willow Creek Reach 3	5.0	3.3	0	9	3
Big Willow Creek Reach 4	5.1	1.5	0	6	2
Big Willow Creek Reach 5	19.5	15.0	2	35	12.2
Big Willow Creek Reach 6	1.2	0.9	0	4	1.4
Big Willow Creek Reach 7&8	9.4	7.9	1	24	7.5
Big Willow Creek Reach 9	12.0	10.2	1	44	12.1



Stream Visual Assessment Protocol (SVAP)

SVAP is a qualitative assessment of the stream's health based on a score from 1 to 10 for most categories, with 1 being poor and 10 being good. Manure presence is scored from 1 to 5. Results from the SVAP are shown below in Table 8 and Figure 6. Reach numbers correspond to the order in which they were assessed and not the order from downstream to upstream; although a majority of the reaches were assessed by progressing upstream. Most of the reaches rated in poor condition. This poor rating is primarily due to channel incision (predominantly on one side of the stream), hydrologic alteration, bank instability, lack of bank cover, and diversions which result in low flows and low dissolved oxygen levels that negatively impact the aquatic community. These reaches also have fine sediment deposition instream and presence of invasive weeds along streambanks. The reaches that scored fair or good had less channel alteration and better riparian cover and habitat for macroinvertebrates, fish, and other wildlife. Despite the general poor rating, there was abundant waterfowl present during the assessments. Crawfish and minnows were the dominant aquatic species noted instream.

Table 8. SVAP results for Big Willow Creek watershed

Reach	Length (feet)	Channel Condition	Hydrologic Alteration	Riparian Zone	Bank Stability	Water Appearance	Nutrient Enrichment	Barriers to Fish Movement
BWC 1	1,507	6	4	4	5	8	4	10
BWC 2	3,288	8	4	9	3	4	5	9
BWC 3	2,378	3	2	8	1	3	5	1
BWC 4	2,800	8	9	9	10	4	5	9
BWC 5	1,590	4	4	10	10	5	5	1
BWC 7&8	3,248	10	10	8	10	8	7	10
BWC 9	2,477	3	2	5	5	3	5	1

Reach	Instream Fish Cover	Pools	Insect/ Invertebrate Habitat	Canopy Cover	Manure Presence	TOTAL	SCORE	Rating
BWC 1	2	3	1	2	4	53	4.4	poor
BWC 2	5	5	3	6	X	61	5.5	poor
BWC 3	3	3	1	2	3	35	2.9	poor
BWC 4	4	8	5	7	X	78	7.1	fair
BWC 5	8	7	9	5	X	68	6.2	fair
BWC 7&8	9	5	10	3	X	90	8.2	good
BWC 9	6	4	8	3	X	45	4.1	poor

Streambank Erosion Condition Inventory (SECI)

SECI is a qualitative assessment of the potential for streambank erosion and deposition (Table 9). This assessment is rated from 0 to 3 for the following categories: bank erosion evidence, bank stability condition, bank cover/vegetation, and channel bottom stability. Lateral channel stability is rated from 0 to 2 and in-channel deposition is rated from 0 to -1. Higher scores indicate poorer ratings due to greater potential for soil loss.

The general trend is more stable banks and less deposition in the middle portion of the watershed. There are two known causes for suspended sediment at the lower end of Big Willow Creek: (1) soil type and (2) diversions. First, the soil type along Big Willow Creek is predominantly river wash (a mix of sand, gravels, and cobbles) upstream of the second bridge, but it is a fine sandy loam at the lower end. Loam soils from the floodplain, terraces, and valleys sides of the stream are easily eroded into the stream channel, depositing fine sediment. Some clay inclusions form a compacted hard surface instream in the middle portion of the watershed (www.soildatamart.nrcs.usda.gov). Second, man-made earthen dams upstream release fine sediment into the stream which travels downstream.

Another observation made during our assessment of Big Willow Creek was the change from a shallow, narrow channel to a wider, deeper multi-channel stream, in part due to beaver activity. It has been documented that riparian areas with beaver complexes can have greater water storage capacity, decreased peak runoff, raised water table, altered groundwater flow patterns, waterlogged or wetland conditions, sediment and nutrient trapping, greater nitrogen fixation, water temperature moderation or warming, and shifts in fish, invertebrate, and plant community structure (Collen and Gibson 2001, Maret et al. 1987, McDowell and Naiman 1986, Rosell et al. 2005, Westbrook et al. 2005). There is likely sediment trapping by beaver complexes in the middle portion of the Big Willow Creek, however, the extent of such trapping varies depending on the size of dam, condition of the dam, location of the dam, and the number of dams. Further information describing the affects of beaver activity in the watershed is found in Appendix C.

Table 9. SECI results for Big Willow Creek watershed

Reach	Bank Erosion Evidence	Bank Stability Condition	Bank Cover/ Veg.	Lateral Channel Stabilty	Channel Bottom Stability	In-Channel Deposition	TOTAL	Bankfull Width (feet)
BWC 1	1	0.5	1	0	0.5	1	4	45
BWC 2	1	0	0.5	1	0.5	1	4	36
BWC 3	0	0.5	1	0	1	1	3.5	28
BWC 4	0	0	0	0.5	0.5	1	2	29
BWC 5	0	0.5	0	0	0	1	1.5	18
BWC 7&8	0.5	0.5	0	0.5	0	1	2.5	50
BWC 9	0.5	0	0.5	1	0	1	3	22

In addition to the information collected by solar pathfinder, SVAP, and SECI; SWC measured bankfull width for stream reaches between the confluence of Big Willow Creek and the Payette River and the confluence of Big Willow Creek and Dry Creek (Table 9). DEQ measured bankfull width from near the confluence of Big Willow Creek and the Payette River, the confluence of Big Willow Creek and Sucker Creek, and upstream of the confluence of Big Willow Creek and Rock Creek. The only overlapping reaches assessed by both agencies are near the confluence of Big Willow Creek and the Payette River. SWC bankfull measurements are greater than the two DEQ field measurements recorded for AU #04 in Table C-5 of the Big Willow Creek SBA-TMDL by DEQ. In contrast, estimated stream width values recorded in Table 22 of the Big Willow Creek SBA-TMDL are greater than SWC's bankfull width measurements. When considering the smaller bankfull widths measured by SWC, the results from the loading analysis would be higher effective shade values and smaller solar loads.

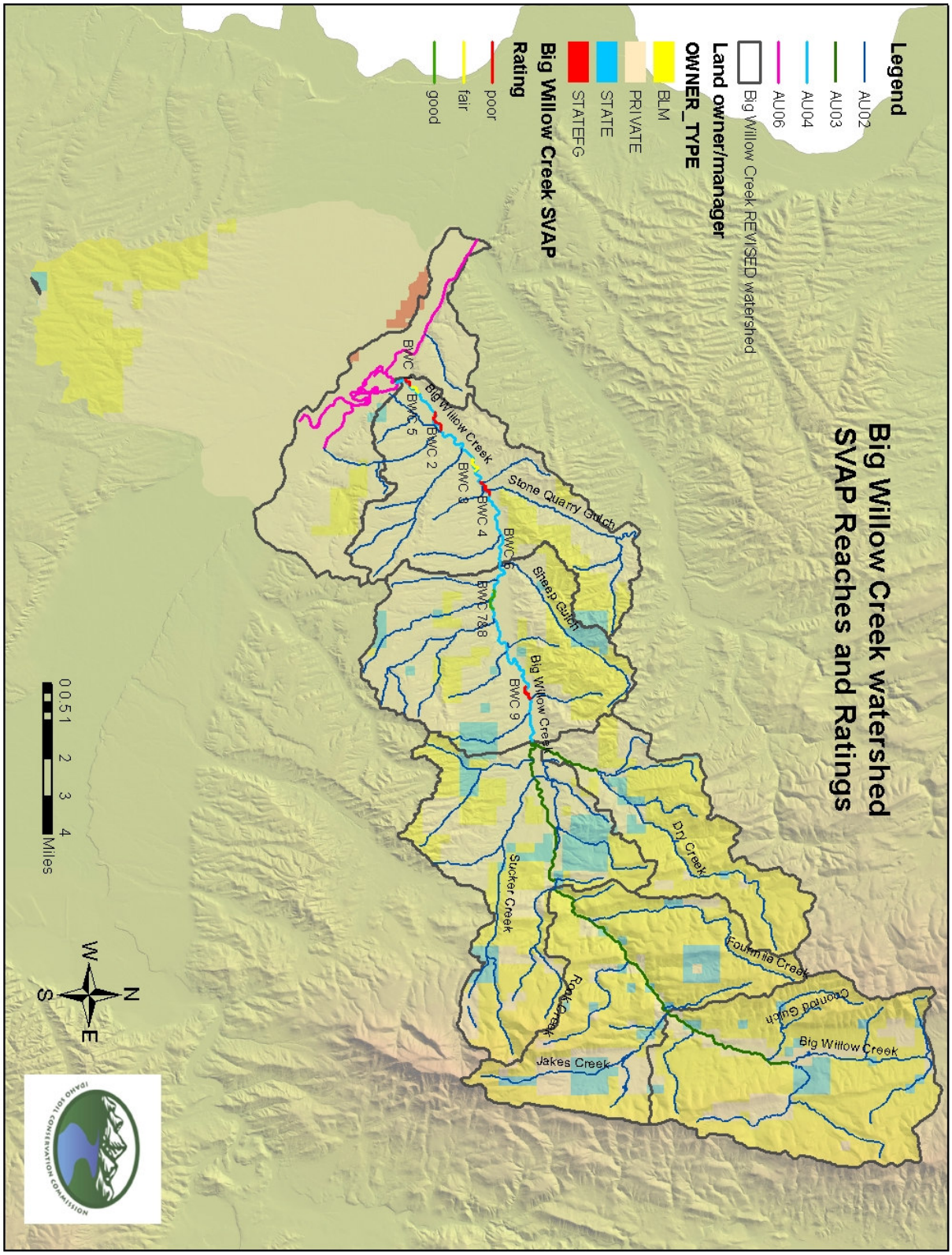


Figure 6. SVAP ratings for stream reaches inventoried in the Big Willow Creek watershed

ANIMAL FEEDING OPERATIONS AND DAIRIES

There are five dairies, totaling 5,575 animals in the Big Willow Creek watershed (ISDA 2009, www.idwr.state.id/gisdata/gisdata-new.htm). These dairies lie south of the Payette River, so they are not considered in this implementation plan. They are not adjacent to any 303(d)/305(b) listed streams; however they may impact groundwater and surface waters in the watershed. All licensed dairies are required to have a nutrient management plan according to Idaho law, *I.C. §37-401, Title 37, Chapter 4, Sanitary Inspections of Dairy Products* (http://www.agri.state.id.us/Categories/Animals/Dairy).

There is one approved cattle feeding operation in the watershed. Cattle feedlots are governed by IDAPA 02.04.15, Rules Governing Beef Cattle Animal Feeding Operations. ISDA has been responsible for regulation of beef and dairy CAFOs.

GROUNDWATER CONCERNS

The Lower Payette Nitrate Priority Area is located in the southern portion of the Big Willow Creek watershed (Figure 2). This area encompasses about 19 miles^2. There has been relatively little change in percent nitrates in the area since the 2002 Final Nitrate Priority Area Ranking (http://www.deq.state.id.us/water/data_reports/ground_water/reports.cfm#recharge).

Groundwater quality monitoring conducted from 2003 to 2006 by the ISDA indicates that nitrate contamination exists around New Plymouth. Pesticides, such as atrazine and desethyl atrazine, were also detected in the groundwater (Carlson and Atlakson 2007).

INVASIVE SPECIES

There are several invasive or non-indigenous fish and invertebrate species that are documented to exist in the Middle Snake River drainage (http://nas.er.usgs.gov/queries/huc6nw.asp). Aquatic and terrestrial noxious weeds that may exist in Payette and Gem counties are listed below (University of Idaho, 2008). Invasive species were recorded during agricultural inventory and evaluation in order to determine future control measures.

Fishes

- Brown trout, carp, tilapia

Invertebrates

- New Zealand mudsnail

Plants

- AQUATIC : Parrot feather (Brazilian watermilfoil), Eurasian watermilfoil, feathered mosquitofern, Brazilian waterweed, hydrilla, yellow iris, purple loosestrife
- TERRESTRIAL: Buffalobur, Canada thistle, Dalmatian toadflax, diffuse knapweed, field bindweed, houndstongue, Japanese knotweed, jointed goatgrass,

leafy spurge, Mediterranean sage, muskthistle, oxeye daisy, perennial pepperweed, poison hemlock, puncturevine, purple loosestrife, rush skeletonweed, Russian knapweed, saltcedar, Scotch thistle, spotted knapweed, whitetop, yellow starthistle, and yellow toadflax

THREATENED AND ENDANGERED SPECIES

Bull trout, *Salvelinus confluentus,* are listed as threatened in the Lower Payette River subbasin in Gem, Payette, and Washington counties (http://www.fws.gov/idahoes/IdahoCounties.htm). However, there appear to be no known bull trout populations in Big Willow Creek (http://map.streamnet.org/website/bluesnetmapper/viewer.htm).

The Northern Idaho ground squirrel, *Spermophilus brunneus brunneus,* is listed as threatened in Adams County and its home range area falls within the Big Willow watershed.

The Southern Idaho ground squirrel, *Spermophilus brunneus endemicus,* is listed as candidate species and it is located in the Payette River subbasin in Adams, Gem, and Washington counties.

The southern portion of the Big Willow Creek watershed, south of A-Line Canal, is a Long-Billed Curlew habitat area. The Long-Billed Curlew, *Numenius americanus*, is a bird that nests and breeds in this area. BLM has classified this as an area of critical environmental concern (www.blm.gov). The Idaho Department of Fish and Game (IDFG) listed the Long-Billed Curlew as a candidate species and species of special concern because of population declines and localized population distribution (*www*.fishandgame.idaho.gov/cms/tech/CDC/cwcs.../Long-billed%20Curlew.pdf).

Agricultural conservation planning will be coordinated with other species recovery and protection efforts in the watershed to consider listed species' habitats and address any potential impacts from BMP implementation. Improvements in water quality, achieved from BMPs installed on agricultural lands, are not expected to adversely affect these listed species and should improve or enhance their habitat. Any BMP implementation that will affect T&E species or habitat will follow Endangered Species Act (ESA) consultation requirements.

WETLANDS

Wetlands are lands that are inundated by water or have saturated soil for significant periods of time. Wetlands are important because they contain a wide variety of plant and animal species and they function as natural filters (http://www.epa.gov/owow/wetlands). The area surrounding the Lower Payette Ditch and the Payette River contains freshwater emergent wetlands. There are also several small wetlands (emergent and forested/shrub) where Big Willow Creek turns into the Lower Payette Ditch. In a separate portion of the watershed, Big Willow Creek near Conrad Gulch contains both freshwater emergent and

forested/shrub wetlands (http://www.fws.gov/wetlands/Data/Mapper.html). Big Willow Creek from Jakes Creek to Rock Creek and Birding Island to Diversion Dam is considered scenic by IDFG.

Treatment

Figure 7 illustrates the proposed subwatersheds for treatment. Only subwatersheds that drain into Big Willow Creek are considered. Subwatersheds that lie south of the Payette River are not included in this implementation plan. Please refer to the Lower Payette TMDL Implementation Plan and Addendum to the Lower Payette River SBA and TMDL (IDEQ 2003) for further information regarding the Payette subwatershed and boundaries.

CRITICAL AREAS

Areas of agricultural lands that contribute excessive pollutants to water bodies are defined as critical areas for BMP implementation. Critical areas are those areas in which treatment is considered necessary to address resource concerns affecting water quality. Critical areas are prioritized for treatment based on their location to a water body of concern and the potential for pollutant transport and delivery to the receiving water body. Critical areas in this plan are cropland, pastureland, and rangeland adjacent to Big Willow Creek that serve as a direct pathway for pollutant entry into Big Willow Creek.

Because Big Willow Creek has been listed as impaired by temperature, implementation efforts should initially focus on the riparian corridor. Currently, all four assessment units do not meet the temperature TMDL requirements. Reaches within these assessment units were separated into tiers (Figure 8) according to the shade analysis in the Big Willow Creek Assessment and Temperature TMDL (IDEQ 2008) (Figure 9). Tier 1 reaches have the greatest difference between target and existing shade (or the largest percent lack of shade); tier 2 reaches have the second greatest difference, and Tier 3 reaches have the smallest percent lack of shade. These tiered reaches of the stream have a lack of or a loss of riparian cover that typically sustains suitable instream temperatures for macro-invertebrates and fishes, i.e. cold water aquatic life.

ArcView GIS 9.3 software, NAIP imagery, topographic maps, land ownership, cropland units, field investigations, previously treated areas, and DEQ shade analysis were used to delineate riparian areas that fall under a particular tier.

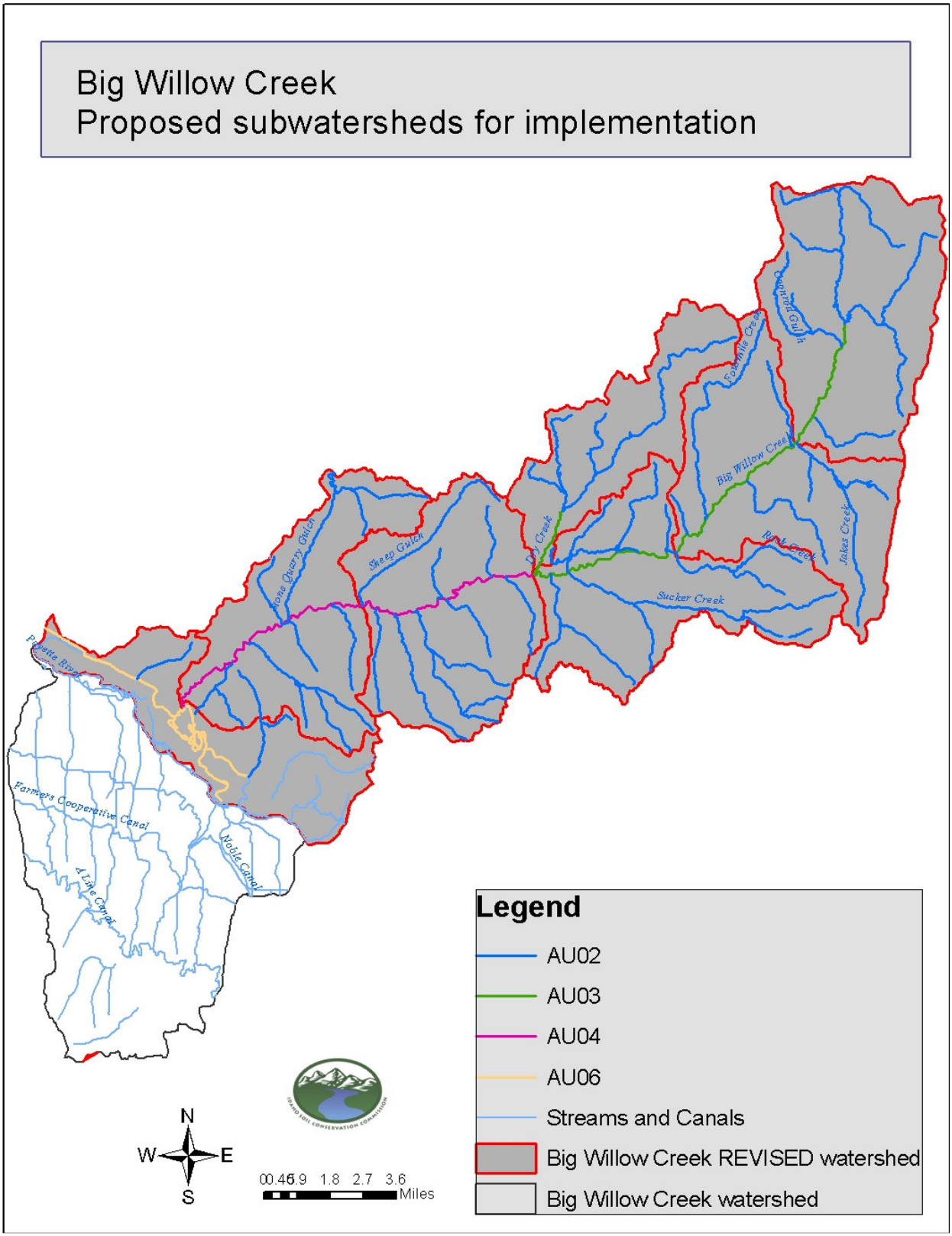


Figure 7. Proposed subwatersheds for BMP implementation in the Big Willow Creek watershed

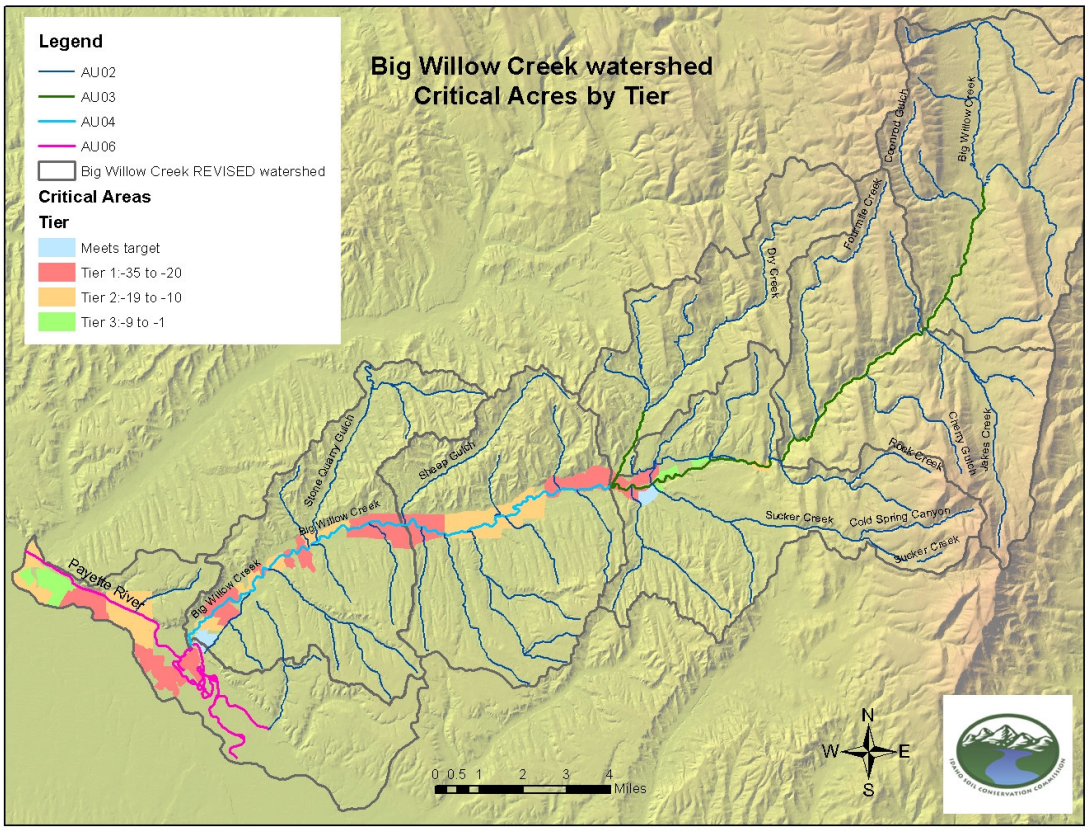


Figure 8. Big Willow Creek watershed Critical Areas by Tier

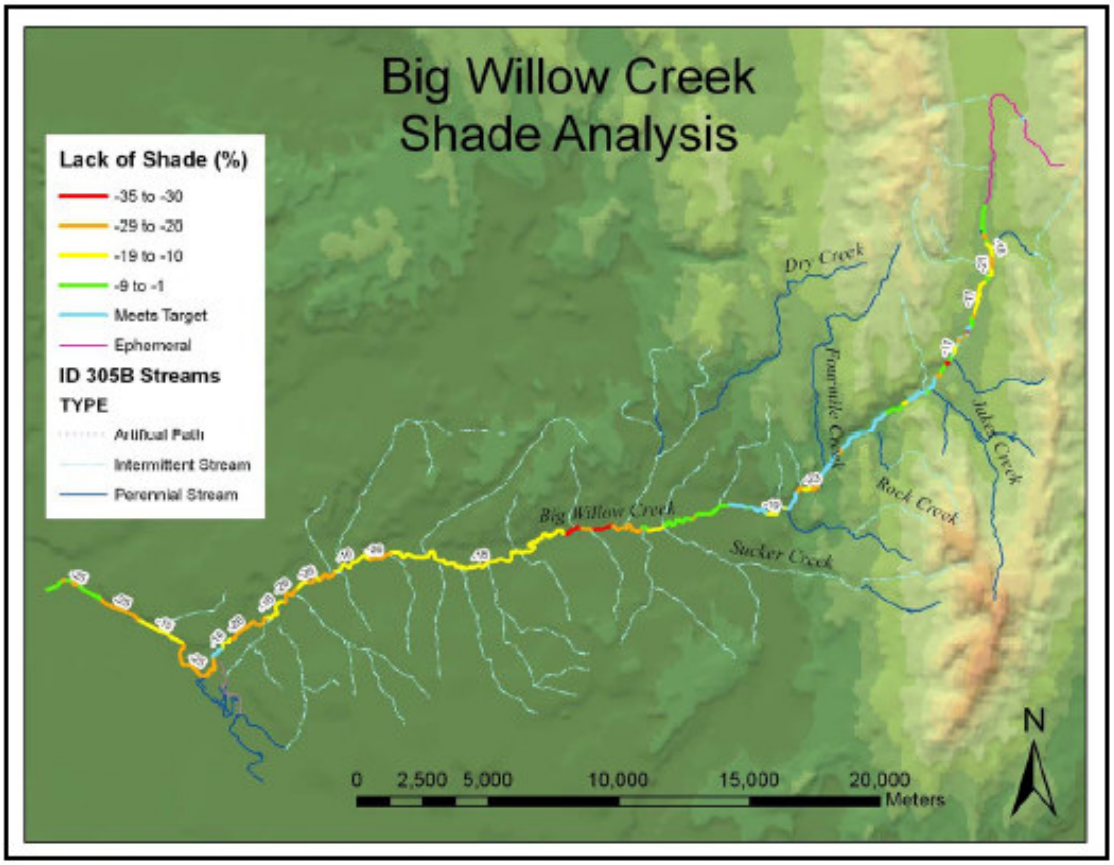


Figure 9. Shade Analysis from the Big Willow Creek Watershed SBA-TMDL (IDEQ 2008)

TIERS

	% Lack of Shade
Tier 1	-35 to -20 percent lack of shade
Tier 2	-19 to -10 percent lack of shade
Tier 3	-9 to -1 percent lack of shade

Description of tiers for Big Willow Creek Assessment Units

Assessment Unit #02
Shade analysis was not conducted on the tributaries that enter into Big Willow Creek. The predominant land use for this assessment unit is rangeland and forest.

Assessment Unit #03
There is a small reach between Dry Creek and Sucker Creek that falls under the Tier 2 category. A Tier 3 reach exists from Sucker Creek to Sulphur Gulch. Land ownership changes from private to BLM just upstream from Rock Creek. The predominant land use for this assessment unit is pasture and rangeland.

Assessment Unit #04
Interspersed Tier 1 and Tier 2 category reaches are located between the confluence of Big Willow Creek and the Payette River and the confluence of Big Willow Creek and Sheep Gulch. A long Tier 2 reach exists just upstream of the confluence of Big Willow Creek and Sheep Gulch to Bannister Basin. At this point the remainder of AU #04 falls under the Tier 1 category. Big Willow Creek should be targeted for impoundment improvements and irrigation water conveyance upgrades in this assessment unit. Four major diversions were located during the stream assessment. In stream control structures and reservoirs for irrigation can also be found along the tributaries of Big Willow Creek, above the confluence of Dry Creek and Big Willow Creek, and where Big Willow Creek flows into Payette Ditch.

Water quality concerns for stream reaches inventoried in 2009 are as follows. BWC 1 is impacted by noxious weeds. Bank erosion and bank incision are concerns for BWC 2. Channel bank vegetation and channel stabilization may be required to prevent streambank erosion in this reach. BWC 3 contains unstable streambanks due to livestock access to the riparian corridor and stream. A diversion exists in this reach. BWC 4 receives water from the Stone Quarry Gulch, which contains multiple ponds. A beaver dam exists in this reach. BWC 5 contains an earthen diversion, which contributes fine sediment instream. BWC 6 is a series of beaver dam complexes. There is a stream crossing present. BWC 7&8 have unstable streambanks that may require stabilization with riparian plantings. Streambank erosion and bank incision generated downstream of an earthen diversion is contributing fine sediment instream for BWC 9. The predominant land use for this assessment unit is pasture and rangeland.

Assessment Unit #06
Tier 1 and 2 reaches exist in this assessment unit. Big Willow Creek flows into Payette Ditch. Water eventually flows into the Payette River. Historical channel modification

has dramatically altered the course of the natural stream channel. The predominant land use for this assessment unit is cropland and pasture.

TREATMENT UNITS (TU)

The following treatment units (TUs) describe areas in the Big Willow Creek watershed with similar land uses, soils, plant communities, resource concerns, and treatment needs. These TUs not only provide a method for describing land use, but are also used to evaluate land use impacts to water quality and to formulate alternatives for solving water quality problems. Treatment units for the Big Willow Creek watershed focus on the riparian corridor and include cropland, irrigated grass/pasture/hayland, and rangeland. BMPs are suggested for each treatment unit. BMPs will focus on riparian and wetland management using channel stabilization, channel vegetation, critical area planting, fence, riparian forest buffer, tree and shrub establishment, use exclusion, and watering facilities. Figure 7 depicts the subwatersheds proposed for treatment. Subwatersheds not included in this figure do not directly influence the listed stream. Table 10 shows treatment units sorted by tier, soils, resource concerns, and plant form. Plants are described here because knowledge of present day and potential natural vegetation (PNV) is required in order to determine which plant materials would be best suited for revegetation purposes. Common plant names are provided as a general reference for what currently exists or may exist in the Big Willow Creek watershed based on climate, physiographic features, soils, and ecoregion (Hansen and Hall 2002, Hoag et al. 2008, Powell, et al. 2007, www.esis.sc.egov.usda.gov, www.natureserve.org/explorer). This list is not all inclusive. It contains introduced plants as documentation of what exists now. Plants selected for revegetation purposes should be native species.

Potential Natural Vegetation (PNV)

Potential Natural Vegetation (PNV), as described by the DEQ below, is an analysis conducted by the DEQ to determine target stream temperatures. Shade targets are established based on plant community type and estimated bankfull width.

> Potential natural vegetation (PNV) along a stream is that intact riparian plant community that has grown to its fullest extent and has not been disturbed or reduced in any way. The PNV can be removed by disturbance either naturally (wildfire, disease/old age, wind-blown, wildlife grazing) or anthropogenically (domestic livestock grazing, vegetation removal, erosion). The idea behind PNV as targets for temperature TMDLs is that PNV provides a natural "mature state" level of solar loading to the stream. Anything less than PNV results in the stream heating up from either naturally created or anthropogenically created additional solar inputs.
>
> ….The types identified in the literature, in order from greatest to least percent cover, are shrub/steppe annual grass, perennial grassland, agriculture, sagebrush, bitterbrush, shrub-dominated riparian, and evergreen forest (< 1%) (Payette County, 2004). Native upland vegetation in the Big Willow Creek watershed consists mostly of sagebrush/steppe (grasses and shrub) community type. However, the increased occurrence of wildland fires in the area has created an exotic cheat grass (*Bromus tectorum*) community type, evident throughout the basin, but not mentioned in the literature (Shumar, 2005). Deciduous woody species of the shrub-dominated riparian community consist of small willows (Salix sp.), dogwood (Cornus sp.), and birch (Alder sp. and Birch sp.) near springs and in the riparian zone. Cottonwoods (Popular sp.), although scarce, do exist along low-gradient stream segments.

Table 10. Treatment Units in the Big Willow Creek watershed.

Treatment Unit Description	Trees	Shrubs	Forbs	Grasses, Rushes, Sedges
Treatment Unit 1-Cropland 1,157 total acres				
Tier 1 343 acres			alfalfa	bulbous bluegrass
Tier 2 474 acres			blue mustard	cheatgrass
Tier 3 300 acres			Canada thistle	crested wheatgrass
			field bindweed	
Soils			puncture vine	
Greenleaf silt loam			tansymustard	
Haw loam			whitetop	
Chance and Moulton fine sandy loams				
Resource Concerns				
irrigation induced erosion				
inefficient water use				
invasive species				
plant condition (pests)				
groundwater qualtiy				
soil condition				
surface water quality				
aquifer overdraft				
Treatment Unit 2-Grass/Hayland/Pastureland 1,465 total acres				
Tier 1 1,024 acres	black cottonwood	coyote willow	alfalfa	baltic rush
Tier 2 303 acres	hawthorn	Booth willow	amaranth	beaked sedge
Tier 3 71 acres	narrowleaf cottonwood	Geyers willow	Canada thistle	bluebunch wheatgrass
	quaking aspen	pacific willow	field pennycress	cheatgrass
Soils	russian olive		goldenweed	common cattail
Greenleaf silt loam, Newell clay loam			houndstongue	crested wheatgrass
Harp and Haw loams			nightshade	field horsetail
Moulton fine sandy loams			poison hemlock	jointed goatgrass
Resource Concerns			poison ivy	lesser panicled sedge
habitat alteration-F&W			ragweed	orchard grass
inadequate feed and forage for livestock			sheep sorrel	panicled bulrush
inefficient water use			veronica	spikerush
invasive species			whitetop	tall fescue
plant productivity/plant health and vigor			yellow monkeyflower	timothy
soil compaction				water sedge
streambank erosion				
surface water quality				
Treatment Unit 3-Rangeland 2,233 total acres				
Tier 1 0 acres		antelope bitterbrush	Aase onion	bluebunch wheatgrass
Tier 2 981 acres		big sagebrush	arrowleaf balsamroot	bottlebrush squirreltail
Tier 3 1,252 acres		coyote willow	bastard toadflax	bulbous bluegrass
		gray rabbitbrush	biscuitroot	cheatgrass
Soils		greasewood	buckwheat	crested wheatgrass
Haw loam (3-12% slope)		mountain big sagebrush	cow parsnip	Cusicks bluegrass
Lolalita-Saralegui assoc. steep		Rocky Mountain juniper	Cusick's camas	Great Basin wildrye
Payette-Van Dusen assoc. steep		silver sagebrush	fiddleneck	Indian ricegrass
Resource Concerns		snowbrush ceanothus	geranium	Idaho fescue
inadequate cover and shelter for fish & wildlife		Wyoming sagebrush	hawksbeard	medusahead rye
invasive species			lupine	Mountain brome
plant productivity/plant health and vigor			Packard's desert parsley	needle and thread grass
soil erosion-overland flow			Packard's milkvetch	prairie junegrass
streambank erosion			penstemon	Sandberg's bluegrass
surface water quality			slickspot peppergrass	spikerush
water quantity (livestock water supply)			tapertip onion	water sedge
wildfire hazard			wooly sunflower	
			yarrow	

RECOMMENDED BMPS AND ESTIMATED COSTS

There are several BMPs that may be applied to the above described treatment units in the proposed watershed to improve water quality. As a result of the water quality inventory and evaluation, personal communication with Mike Raymond, and other research outlined in this implementation plan, the following strategies are recommended.

Treatment Unit #1 Cropland

Practices that may be applied to the small portion of cropland that exists in the Big Willow Creek watershed, north of the Payette River, include irrigation water management, nutrient management, and pest management. The soils are deposited alluvium with hydric soil properties that create flooding and anaerobic conditions. These soils are poorly drained and suitable for irrigated cropland, pasture, wildlife, and wetlands. Some areas, characterized by Chance soils, may be converted to wetlands to treat runoff and provide wildlife habitat.

Treatment Unit #2 Irrigated Grass/Pasture/Hayland

Proper irrigation water management is critical for grass/pasture/hayland. Practices applied to this land use in the past include surface irrigation improvements (conversion from earthen ditch to concrete ditch). Irrigation system upgrades, such as conversion from flood irrigation to sprinkler irrigation via pivots would reduce irrigation induced runoff and soil loss. Other practices, such as use exclusion, pasture and hayland planting, nutrient management, and upland wildlife habitat will likely improve pasture condition and forage value.

Treatment Unit #3 Rangeland

Rangeland has the greatest need for improvement; however, major challenges exist in trying to restore perennial grasses to rangeland in this watershed. A majority of the rangeland is in poor condition, in part due to infestation with annual, introduced species, such as cheat grass, medusahead rye, and bulbous bluegrass. Noxious weeds are a major concern along riparian corridors of Big Willow Creek. There is an overabundance of poison hemlock, houndstongue, thistle, and whitetop. Landowners have taken proactive steps towards minimizing noxious weed infestation by using biological control agents and/or herbicides. Continued control of noxious weeds is recommended.

Water development and maintenance and cross fencing may improve range productivity and condition by managing livestock distribution. They are needed to the east and south of Big Willow Creek on both private and public lands. Some other practices that may be applied to rangeland include range planting/seeding, use exclusion, prescribed grazing, and pest management to control noxious weeds. Prescribed grazing may be difficult to implement because quality forage is not available throughout most of the watershed. Some of the draws, especially Stone Quarry Gulch and Sheep Gulch, eventually drain into Big Willow Creek. Beaver dams and/or diversions are already in place at these locations to store water. Riparian buffer strip, riparian herbaceous cover, and wetland enhancement/restoration at these entry points can be used to create a natural filter system

to remove pollutants, restore hydrology, increase canopy cover, and improve wildlife habitat.

Treatment Unit #4 Riparian

Riparian areas, areas adjacent to a stream, are found within cropland, grass/pasture/hayland, and rangeland units, but they are broken out in Table 11 for purposes of BMP implementation.

Most of the treatment needed along riparian corridors involves planting vegetation; however, we acknowledge that high/low flow regimes limit the success of such efforts. High water velocity and volume during spring runoff scours banks and prevents proper plant establishment. In addition, low flows as a result of water withdraws during the irrigation season also prevent plant growth and establishment. Because of these factors, some of the past willow plantings in the watershed have been unsuccessful. Consistent water levels are needed in order to establish vegetation along Big Willow Creek.

An estimate of BMPs appropriate for the reduction of agricultural impacts to water quality in the Big Willow Creek watershed and their installation costs are shown in Table 11. Recommended BMPs which are specific to riparian areas can be found in Appendix B, Table 12. BMPs in this table have been sorted into three phases of implementation. Phase 1 of implementation focuses on providing off-site water and fencing in order to remove livestock from riparian areas while providing adequate food and water for livestock. Phase 2 involves installing the structural components necessary for streambank stabilization. Streambank stabilization may be needed in areas where vertical banks are high and incised. This allows for proper grading before planting vegetation. The final phase, Phase 3, is revegetation of selected areas along Big Willow Creek with a diverse native plant community.

Individual conservation planning with willing landowners will determine the most appropriate BMPs to install on a case by case basis. A more precise estimate of BMPs recommended to install will be determined at the time of conservation planning for a particular landowner.

A 5 year implementation plan table can be found in Appendix A. This table is a suggested list of implementation activities aimed towards restoration of beneficial uses for Big Willow Creek. Activities outlined in the plan are intended to reduce pollutant loading as well as to decrease instream water temperatures and improve shade by restoring canopy cover along Big Willow Creek.

Table 11. Recommended BMPs by treatment unit and estimated total costs.

PRACTICE	UNIT	CODE	COST/ UNIT	**Cropland**	**Pasture**	**Rangeland**	**Riparian**	Total Amount	TOTAL COST
Channel bank vegetation, willow pole	ft	322	$2.05				908	908	$1,861.40
Channel stabilization, rock rip-rap, barbs	ft	584	$18.75				908	908	$17,025.00
Comprehensive nutrient management plan	no	100	$2,500.00		1			1	$2,500.00
Conservation cover, native	ac	327	$105.00				18	18	$1,890.00
Conservation cover, non-native	ac	327	$57.00	1,401				1,401	$79,862.70
Cover crop	ac	340	$25.00	160				160	$4,000.00
Fence, barb wire	ft	382	$2.02				91,800	91,800	$185,436.00
Heavy use area protection	ft^2	561	$0.68			75	400	475	$323.00
Irrigation system, sprinkler, wheel line	ac	442	$230.00		560			560	$128,823.00
irrigation water conveyance, pipeline	ft	430EE	$6.03		26,300			26,300	$158,589.00
Irrigation water management	ac	449	$5.00	1,401	1,216			2,617	$13,085.50
Nutrient management	ac	590	$5.00	1,401	1,216			2,617	$13,085.50
Pasture and hayland planting	ac	512	$122.00		1,216			1,216	$148,352.00
Pest management, irrigated cropland	ac	595	$15.00	1,401				1,401	$21,016.50
Pest management, riparian-noxious weeds	ac	595	$30.00				31	31	$930.00
Pest management, range-noxious weeds	ac	595	$30.00			1,364		1,364	$40,914.00
Pipeline (PVC, HDPE, or PE pipe 2")	ft	516	$2.40			50,000		50,000	$120,000.00
Pumping plant	hp	533	$200.00			45	2	47	$9,400.00
Prescribed grazing	ac	528	$7.00		1,216	1,364		2,580	$18,058.60
Range planting	ac	550	$50.00			1,364		1,364	$68,190.00
Riparian forest buffer	ac	391	$1,125.00				2	2	$2,250.00
Riparian herbaceous cover	ac	390	$225.00				2	2	$450.00
Stream crossing	ac	578	$2,625.00				1	1	$1,312.50
Streambank and shoreline protection, rip-rap, barbs	ft	580	$45.00				908	908	$40,860.00
Structure for water control	ft	587	$28.00			3		3	$84.00
Tree/shrub establishment, planting only	ea	612	$0.75				200	200	$150.00
Tree and shrub establishment, site prep	ac	490	$63.00				93	93	$5,833.80
Upland wildlife habitat management	ac	645	$10.00		1,216	1,335		2,551	$25,506.00
Use exclusion	ac	472	$34.00		1,216	1,335	20	2,571	$87,400.40
Water and sediment control basin	ea	638	$400.00			2		2	$800.00
Watering facility, trough	ea	614	$1,233.00			3	34	37	$45,621.00
Water well	ft	642	$22.50				1,000	1,000	$22,500.00
Wetland ehancement (riparian area)	ac	659	$191.00	192			20	212	$40,492.00
Wetland restoration	ac	657	$467.00	192			20	212	$99,004.00
Wetland wildlife management	ac	644	$10.00	192			20	212	$2,120.00
GRAND TOTAL									$1,243,609.90

ALTERNATIVES

The TMDL implementation planning process included assessing impacts to water quality in the Big Willow Creek watershed from agricultural lands on 303(d) listed streams and recommending a priority for installing BMPs to meet water quality objectives stated in the Big Willow Creek SBA-TMDL. Data from water quality monitoring and field inventory and evaluations were used to identify critical agricultural areas affecting water quality and set priorities for treatment.

RECOMMENDED ALTERNATIVES FOR BMP IMPLEMENTATION

Implementation of BMPS will involve ongoing cooperation with the Payette and Gem SWCDs to evaluate alternatives and carry out implementation. The chosen treatment alternative is likely to be alternative # 4.

Describe alternatives (examples):
1. no action
2. implement all recommended BMPs per Table 11.
3. implement BMPs for only the tier 1 reaches
4. implement BMPs based on available funding and landowner interest

Funding

Financial and technical assistance for installation of BMPs is needed to ensure success of this implementation plan. The Gem Soil and Water Conservation District, Payette Soil and Water Conservation District, and the Weiser Soil Conservation District, with the technical assistance from IASCD, SWC, and NRCS, will actively pursue multiple potential funding sources to implement water quality improvements on private agricultural and grazing lands. Many of these programs can be used in combination with each other to implement BMPs. These sources include (but are not limited to):

CWA 319 –These are Environmental Protection Agency funds allocated to the Nez Perce Tribe and the State of Idaho. The Idaho Department of Environmental Quality (DEQ) administers the Clean Water Act §319 Non-point Source Management Program for areas outside the Nez Perce Reservation. Funds focus on projects to improve water quality and are usually related to the TMDL process. The Nez Perce tribe has CWA 319 funds available for projects on Tribal lands on a competitive basis. http://www.deq.idaho.gov/water/prog_issues/surface_water/nonpoint.cfm#management

Water Quality Program for Agriculture (WQPA) –The WQPA is administered by the Idaho State Soil and Water Conservation Commission (SWC). This program is also coordinated with the TMDL process. http://www.scc.state.id.us/programs.htm

Resource Conservation and Rangeland Development Program (RCRDP) –The RCRDP is a loan program administered by the SWC for implementation of agricultural

and rangeland best management practices or loans to purchase equipment to increase conservation. http://www.scc.state.id.us/programs.htm

Conservation Improvement Grants – These grants are administered by the SWC. http://www.scc.state.id.us/programs.htm

PL-566 –This is the small watershed program administered by the USDA Natural Resources Conservation Service (NRCS).

Agricultural Management Assistance (AMA) –The AMA provides cost-share assistance to agricultural producers for constructing or improving water management structures or irrigation structures; planting trees for windbreaks or to improve water quality; and mitigating risk through production diversification or resource conservation practices, including soil erosion control, integrated pest management, or transition to organic farming. http://www.nrcs.usda.gov/programs/ama/

Conservation Reserve Program (CRP) –The CRP is a land retirement program for blocks of land or strips of land that protect the soil and water resources, such as buffers and grassed waterways. http://www.nrcs.usda.gov/programs/crp/

Conservation Technical Assistance (CTA) –The CTA provides free technical assistance to help farmers and ranchers identify and solve natural resource problems on their farms and ranches. This might come as advice and counsel, through the design and implementation of a practice or treatment, or as part of an active conservation plan. http://www.nrcs.usda.gov/programs/cta/

Environmental Quality Incentives Program (EQIP): EQIP offers cost-share and incentive payments and technical help to assist eligible participants in installing or implementing structural and management practices on eligible agricultural land. http://www.nrcs.usda.gov/programs/eqip/

Wetlands Reserve Program (WRP) –The WRP is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. Easements and restoration payments are offered as part of the program. http://www.nrcs.usda.gov/programs/wrp/

Wildlife Habitat Incentives Program (WHIP) –WHIP is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. Cost-share payments for construction or re-establishment of wetlands may be included. http://www.nrcs.usda.gov/programs/whip/

State Revolving Loan Funds (**SRF) –**These funds are administered through the SWC. http://www.scc.state.id.us/programs.htm

Grassland Reserve Program (GRP) –The GRP is a voluntary program offering landowners the opportunity to protect, restore, and enhance grasslands on their property. http://www.nrcs.usda.gov/programs/GRP/

Conservation Security Program (**CSP) –**CSP is a voluntary program that rewards the Nation's premier farm and ranch land conservationists who meet the highest standards of conservation environmental management. http://www.nrcs.usda.gov

Grazing Land Conservation Initiative (**GLCI) –**The GLCI's mission is to provide high quality technical assistance on privately owned grazing lands on a voluntary basis and to increase the awareness of the importance of grazing land resources. http://www.glci.org/

Habitat Improvement Program (HIP) – This is an Idaho Department of Fish and Game program to provide technical and financial assistance to private landowners and public land managers who want to enhance upland game bird and waterfowl habitat. Funds are available for cost sharing on habitat projects in partnership with private landowners, non-profit organizations, and state and federal agencies.
http://fishandgame.idaho.gov/cms/wildlife/hip/default.cfm

Partners for Fish and Wildlife Program in Idaho – This is a U.S. Fish and Wildlife program providing funds for the restoration of degraded riparian areas along streams, and shallow wetland restoration. http://www.fws.gov/partners/pdfs/ID-needs.pdf

Outreach

Conservation partners in the Big Willow Creek watershed will use their combined resources to provide information about BMPs to agricultural landowners and operators within Big Willow Creek watershed. A local outreach plan may be developed. Newspaper articles, district newsletters, watershed and project tours, landowner meetings and one-on-one personal contact may be used as outreach tools.

Outreach efforts may:

- Provide information about the TMDL planning and implementation process
- Inform the public about water quality projects and monitoring results
- Accelerate the development of conservation plans and program participation
- Distribute progress reports
- Enhance technology transfer related to BMP implementation
- Increase public understanding of agriculture's contribution to conserve and enhance natural resources
- Improve public appreciation of agriculture's commitment to meeting the TMDL challenge
- Organize an informational tour bringing together irrigation districts' Board of Directors and Soil Conservation Districts' Board of Supervisors.
- Identify and encourage the adoption of BMPs for land uses in the watershed

Monitoring and Evaluation

FIELD LEVEL

At the field level, annual status reviews should be conducted to insure that the contracts are on schedule and that BMPs are being installed according to standards and specifications. BMP effectiveness monitoring should be conducted on installed projects to determine installation adequacy, operation consistency and maintenance, and the relative effectiveness of implemented BMPs in reducing water quality impacts. This monitoring will also measure the effectiveness of BMPs in controlling agricultural nonpoint-source pollution. These BMP effectiveness evaluations will be conducted according to the protocols outlined in the Agriculture Pollution Abatement Plan and the SWC Field Guide for Evaluating BMP Effectiveness.

WATERSHED LEVEL

At the watershed level, there are many governmental and private groups involved with water quality monitoring. The Idaho Department of Environmental Quality has used the Beneficial Use Reconnaissance Protocol (BURP) to collect and measure key water quality variables that aid in determining the beneficial use support status of Idaho's water bodies. Their determination reports if a water body is in compliance with water quality standards and criteria. In addition, DEQ conducts five-year TMDL reviews.

Annual reviews for funded projects should be conducted to insure the project is kept on schedule. With many projects being implemented across the state, SWC developed a software program to track the costs and other details of each BMP installed. This program can show what has been installed by project, by watershed level, by sub-basin level, and by state level. These project and program reviews will insure that TMDL implementation remains on schedule and on target. Monitoring BMPs and projects will be the key to a successful application of the adaptive watershed planning and implementation process.

References

[BLM] Bureau of Land Management. 2008. Areas of Critical Environmental Concern, Long-billed Curlew Habitat Area of Critical Environmental Concern. http://www.blm.gov/pgdata/etc/medialib/blm/id/plans/cascade_rmp.Par.10718.File.dat/part2_7.pdf

Boyle, S. and S. Owens. 2007. North American Beaver (*Castor canadensis*): A Technical Conservation Assessment. USDA Forest Service, Rocky Mountain Region.

Collen, P. and R.J. Gibson. 2001. The general ecology of beavers (*Castor spp*.) as related to their influence on stream ecosystems and riparian habitats, and the subsequent effects on fish- a review. Reviews in Fish Biology and Fisheries. 10: 439-461

[EPA] Environmental Protection Agency. 2009. Function and values of wetlands. (http://www.epa.gov/owow/wetlands/)

Hansen, P.L. and J.B. Hall. 2002. Classification and Management of USDI's Bureau of Land Management's Riparian and Wetland Sites in Eastern and Southern Idaho. Bitterroot Restoration Inc., Corvallis, MT.

[IDEQ] Idaho Department of Environmental Quality. 2009. Department of Environmental Quality Working Principles and Policies for 2008 Integrated (303[d]/305[b]) Report. IDEQ. Boise, Idaho.

[IDEQ] Idaho Department of Environmental Quality. 2008. Big Willow Creek Assessment and Temperature Total Maximum Daily Load: Addendum to the Lower Payette River Subbasin Assessment and TMDL. IDEQ. Boise, Idaho.

[IDEQ] Idaho Department of Environmental Quality. 2008. 2008 Nitrate Priority Area, Delineation and Ranking Process. IDEQ. Boise, Idaho.

IDEQ. 2003. Lower Payette Total Maximum Daily Load Implementation Plan and Addendum to the Lower Payette River Subbasin Assessment and Total Maximum Daily Load. IDEQ/SWC. Boise, Idaho.

[IDFG] Idaho Department of Fish and Game. 2009. Long-billed curlew. www.fishandgame.idaho.gov/cms/tech/CDC/cwcs.../Long-billed%20Curlew.pdf

[IDWR] Idaho Department of Water Resources. 2000. Idaho GIS Data website. http://www.idwr.state.id.us/gisdata/gis_data.htm.

[ISDA] Idaho State Department of Agriculture. 2000. The Idaho Beef Cattle Environmental Control Memorandum of Understanding, 7pp. ISDA. Boise, Idaho.

ISDA. 2000. Beef Cattle Animal Feeding Operation Program, 3pp. ISDA. Boise, Idaho.

ISDA. 2004. Payette Ditch Water Quality Monitoring Report, April 2003 through October 2003. ISDA. Boise, Idaho.

ISDA. 2007. Regional Ground Water Quality Monitoring Results for Payette and Gem Counties 2003-2006. ISDA. Boise, Idaho

ISDA. 2008. Big Willow Creek Water Quality Monitoring Report, April 2007 to October 2007. ISDA. Boise, Idaho.

Maret, T.J., M. Parker, T.E. Fannin. 1987. The effect of beaver ponds on the non-point source water quality of a stream in southwestern Wyoming. Water Research 21:1-7

McDowell, D.M. and R.J. Naiman. 1986. Structure and function of a benthic invertebrate stream community as influenced by beaver (*Castor canadensis*). Oceologia 68: 481-489

NatureServe. NatureServe Explorer. 2009. www.natureserve.org/explorer

[NRCS] Natural Resource Conservation Service. 2004. NRCS CRA Report. ftp://ftpfc.sc.egov.usda.gov/ID/technical/pdffiles/IdahoCRAReport.pdf.

NRCS. 2009. Guidance Documents for Resource Management Systems. https://csg.sc.egov.usda.gov/CSGReporteFOTG.aspx

NRCS. 2008. Idaho 2008 State EQIP. http://www.id.nrcs.usda.gov/programs/eqip/2008/eqip_practices_08.html

NRCS. 2007. New dam brings safety, water quality, and recreation to Payette County. http://www.id.nrcs.usda.gov/news/newsreleases/bladderdam.html

NRCS. 2007. Payette 17050122 Rapid Watershed Assessment. http://www.id.nrcs.usda.gov/technical/watersheds.html

NRCS. 2005. Lower Payette River Ditch Diversion, Replacement Payette County, Idaho. 0-edocket.access.gpo.gov.library.colby.edu/2005/pdf/05-509.pdf

Rasmussen, Lawrence M. 1976. Soil Survey of Payette County, Idaho. Natural Resource Conservation Service and Soil Conservation District. Boise, Idaho.

Rosell, F. O. Bozser, P. Collen, and H. Parker. 2005. Ecological impact of beavers *Castor fiber* and *Castor canadensis* and their ability to modify ecosystems. Mammal Review 35: 248-276

State of Idaho. 2009. Payette County Assessors office. Payette County Idaho Address Map. http://www.payettecounty.org/maps/maphome.htm

Troeh, F.R., J.C. Chugg, G.H. Logan, C.W. Case, and V. Council. 1965. Soil Survey of Gem County Area, Idaho. Natural Resource Conservation Service and Soil Conservation District.

[USDA] United States Department of Agriculture, NRCS. 2009. Ecological Site Description System. www.esis.sc.egov.usda.gov

USDA, NRCS. 2009. USDA Geospatial Data Gateway. http://lighthouse.nrcs.usda.gov/gateway/gatewayhome.html

USDA, National Agriculture Statistics Service. 2009. County crop data. http://www.nass.usda.gov

[USFWS] United States Fish and Wildlife Service. 2009. Wetland mapper. http://www.fws.gov/wetlands/Data/index.html

USFWS. 2009. Draft Agreement to Protect Northern Idaho Ground Squirrel, Available for Public Comment and Review. USFWS. Boise, Idaho

USFWS. 2003. Idaho endangered, threatened, proposed, and candidate species by county, Adams County. U.S. Fish and Wildlife-Pacific Region.

[USGS] United States Geologic Society. 2009. Non-indigenous aquatic species. http://nas.er.usgs.gov/queries/huc6nw.asp

Westbrook, C.J. D.J. Cooper, and B.W. Baker. 2005. Beaver dams and overbank floods influence groundwater-surface water interactions of a Rocky Mountain riparian area. Water Resources Research 42:1-12

Woo, M.K. and M. Waddington. 1990. Effects of Beaver Dams on Subarctic Wetland Hydrology. Arctic 43: 223-230

Appendices

APPENDIX A

Idaho Soil Conservation Commission					
Action Item(s)	2009	2010	2011	2012	2013
Agricultural Water Quality Inventory and Evaluation					
Pollutant Identification/Monitoring and Evaluation					
Identify water quality concerns on private lands based on the SBA-TMDL generated by DEQ and the watershed planning document generated by ISCC	x				
Re-evaluate water quality concerns based on the 5 year review		x			
Work cooperatively with DEQ to monitor streams by collecting water quality data and by collecting and analyzing solar pathfinder data			x	x	x
Evaluate streambank condition and riparian corridor health			x	x	x
Determine if resources are available to identify contributions from tributaries		x			
Work with DEQ, NRCS, the WAG, and the Payette SWCD to set priorities for monitoring and evaluation	x				
Critical Areas					
Critical Areas Delineation/Treatment					
Determine critical areas for treatment on private lands in the watershed	x				
Visit areas on private lands that are >20% below shade targets outlined in SBA-TMDL	x				
Determine appropriate treatment alternatives for each site	x				
Research and identify appropriate plant materials for revegetation in critical areas	x				
Re-evaluate potential natural vegetation/shade targets based on recent data			x	x	x
Determine appropriate riparian buffer width	x				
Land Use Evaluation					
Contact landowners regarding irrigation system upgrades (conversion from flood to sprinkler irrigation to decrease water temperature of return flow)			x		
Contact landowers regarding diversion improvements to maintain instream flow			x		
Document diversion structure condition	x				
Define critical augmentation periods as they relate to stream channel morphology and riparian plant establishment		x			
Research cause of excess phosphorus as it relates to dissolved oxygen levels			x	x	x
Evaluate livestock management on rangelands and how that relates to livestock rotation on riparian pasture(s)	x				
Monitor intensity of livestock grazing on riparian pastures		x			
Monitor and control presence and distribution of noxious weeds for landowners currently participating in pest management	x	x	x	x	x
Document and select treatment alternatives for unstable, eroding streambanks in order to effectively re-establish plant materials on site	x				
Contact landowners interested in riparian restoration			x		
Contact landowners interested in wetland enhancement			x		
Designate upland wildlife management and wildlife management areas	x				

APPENDIX A CONTINUED

BMP Implementation on Private Lands					
Identify past conservation accomplishments					
Provide a table and summary of past conservation accomplishments	x				
Identify future conservation needs					
Work with NRCS, local districts, the WAG, and landowners to set priorities	x				
Give preference to critical areas for BMP implementation		x	x	x	x
Recommended BMPs and Estimated Costs					
Provide a table and a summary of recommended BMPs and costs	x				
Description of Riparian BMPs					
Establish plans for prescribed grazing and use exclusion with willing landowners			x		
Install use exclusion/prescribed grazing for riparian pastures with willing landowners			x		
Coordinate with willing landowners to maintain or establish riparian buffer strips/herbaceous cover			x		
Arrange range planting/rangeland restoration projects with willing landowners			x		
Install heavy use area protection for road crossings for interested landowners			x		
Install practices to stabilize streambanks with willing landowners			x		
Improve cattle distribution with cross fencing, spring developments, and watering facilities with willing landowners			x		
Riparian BMPs					
Please refer to the Recommended BMPs and Estimated Costs Table 12	x				
Funding					
Strategy					
Coordinate with other agencies to evaluate needs	x	x	x	x	x
Seek and apply for grants, including state and federal funding sources	x	x	x	x	x

APPENDIX B

Table 12. Recommended Riparian BMPs and Estimated Costs

	PRACTICE	UNIT	CODE	COST/ UNIT	**Riparian**	TOTAL COST
Phase 1	Fence, barb wire	ft	382	$2.02	91,800	$185,436.00
Phase 1	Pipeline (PVC, HDPE, or PE pipe 2")	ft	516	$2.40	20,400	$48,960.00
Phase 1	Pumping Plant	ea	533	$2,500.00	2	$5,000.00
Phase 1	Use exclusion	ac	472	$34.00	20	$680.00
Phase 1	Water Well	ft	642	$22.50	1,000	$22,500.00
Phase 1	Watering facility	ea	614	$1,233.00	34	$41,922.00
						$304,498.00
Phase 2	Channel stabilization, rock rip-rap, barbs	ft	584	$18.75	908	$17,025.00
Phase 2	Heavy use area protection	ft^2	561	$0.68	400	$272.00
Phase 2	Pest management- noxious weeds	ac	595	$30.00	31	$930.00
Phase 2	Stream crossing	ac	578	$2,625.00	1	$1,312.50
Phase 2	Streambank and shoreline protection rip-rap/ barbs	ft	580	$45.00	908	$40,860.00
						$60,399.50
Phase 3	Channel bank vegetation, willow pole	ft	322	$2.05	908	$1,861.40
Phase 3	Conservation cover, native vegetation	ac	327	$105.00	18	$1,890.00
Phase 3	Prescribed grazing	ac	528	$7.00	31	$217.00
Phase 3	Riparian herbaceous cover	ac	390	$225.00	2	$450.00
Phase 3	Riparian forest buffer	ac	391	$1,125.00	2	$2,250.00
Phase 3	Tree and shrub establishment, site prep	ac	490	$63.00	93	$5,833.80
Phase 3	Tree/shrub establishment, planting only	ea	612	$0.75	200	$150.00
Phase 3	Wetland enhancement (riparian area)	ac	659	$191.00	20	$3,820.00
Phase 3	Wetland restoration	ac	657	$467.00	20	$9,340.00
Phase 3	Wetland wildlife habitat management	ac	644	$10.00	20	$200.00
						$26,012.20
						$390,909.70

APPENDIX C

The following excerpts are directly from the publication, North American Beaver (*Castor canadensis*): A Technical Conservation Assessment (Boyle and Owens 2007).

No quantitative data exist on beaver abundance or population trend for any Region 2 state. Based on indirect evidence, beaver populations at a broad scale throughout Region 2 are thought to be stable or increasing. However, it should be noted that much of the indirect evidence is from harvest trends, which are strongly influenced by fur prices and other factors besides beaver abundance, and nuisance complaints, which are influenced by changes in human settlement patterns.

Beavers live in colonies, which can be defined as a group of beavers occupying in common a pond, ponds, or a stretch of stream, utilizing the same food cache, and maintaining communal dams where habitat allows (Hay 1955).

Beavers occupy aquatic habitats in a wide variety of ecosystems throughout their North American range, including desert, semiarid shrubland, montane and subalpine forest, and human-altered agricultural lands, rangelands, and urban areas.

Beavers are herbivores, primarily subsisting year round on the inner bark, twigs, leaves, and buds of deciduous woody plants (Wilson and Ruff 1999, Baker and Hill 2003), but they also eat many herbaceous and aquatic plant species, especially in summer (Allen 1983).

Throughout their range, beavers prefer species from the willow family (Salicaceae), especially aspen (*Populus tremuloides*) where it is available (Retzer et al. 1956, Rutherford 1964, Novak 1987, Basey 1999). Beavers in Region 2 also eat other deciduous species including alder (*Alnus* spp.), birch (*Betula* spp.), and currant (*Ribes* spp.).

Reported colony densities range from near zero to at least 4.6 per km^2. Maximum colony density, or saturation point, in most habitats probably ranges from about 0.4 to 1.9 per km^2 (Baker and Hill 2003).

Large herbivores such as deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), and moose (*Alces alces*) may compete with beavers for riparian vegetation. These species may reduce beaver food supply by eating shoots of aspen and other woody species, or by trampling willow stands and suppressing stand reproduction (Rutherford 1964). Livestock, especially cattle, grazing in riparian areas can also degrade beaver habitat by removing woody vegetation (Apple 1985).

In the short term, beaver cutting of woody vegetation can reduce or eliminate tree cover especially near the lodge or pond; tree species may be depleted to the point that beavers abandon the site, while at least some willow stands may be inhabited indefinitely (Baker and Hill 2003). In the long term, beaver damming activity promotes sediment accumulation, promotes water conservation by reducing runoff efficiency, and provides ideal colonization sites for herbaceous and woody riparian vegetation. Beaver herbivory on willow results in a mutualistic interaction in which beaver cutting stimulates willow growth patterns beneficial to beavers and other browsers, at least in the absence of intense browsing by ungulates (Baker et al. 2005).

Because of their extensive habitat modifications, beavers exert a strong influence on their environment (review by Rosell et al. 2005). Beavers affect the structure and function of adjacent terrestrial ecosystems by reducing vegetation height and selectively cutting preferred species (Naiman et al. 1988), which alters the growth form and stand density of cut vegetation (Barnes and Dibble 1986, Dieter 1987). Cutting opens gaps in the forest canopy that favor shade-intolerant species preferred by beavers, particularly aspen (Novak 1987, Fryxell 2001).

Beaver damming in streams influences flooding dynamics, sediment transport, and water storage and release patterns (review in Baker and Hill 2003). By moderating flooding, increasing water storage, and evening water release during drier periods, beaver activity provides ecological benefits. Damming

facilitates the establishment of riparian vegetation by increasing the extent and duration of soil moisture, and by providing sediment for seedling establishment (Baker and Cade 1995).

Development that reduces woody deciduous vegetation or riparian cover and structure adversely affects beaver habitat suitability by reducing the quality and availability of food and construction materials.

Improperly managed livestock grazing in riparian areas can reduce riparian shrub and tree vegetation by browsing and trampling. Livestock use in riparian areas also can cause bank erosion and stream down-cutting (Elliott et al. 1999), which leads to a lowering of the water table, reduction in floodplain area, and degradation or elimination of woody riparian vegetation.

Where beavers occur in developed or agricultural areas, beaver activity often comes into conflict with human land uses. Beavers can damage or destroy ornamental trees, agricultural crops, and timber resources.

A potential landscape-scale threat to beavers is habitat fragmentation caused by human development and associated water development projects. Beaver distribution over time is necessarily dynamic as family groups often deplete food resources and move to new colony sites.

The capability of beavers to store water, trap sediment, reduce erosion, and enhance riparian vegetation can be used as a management tool to restore degraded aquatic and riparian ecosystems (Baker and Hill 2003, Müller-Schwarze and Sun 2003, Rosell et al. 2005). Beavers are a habitat-modifying keystone species and play a pivotal role in influencing community structure in many riparian and wetland systems (Mills et al. 1993).

Beaver habitat modifications can reduce pollution and improve water quality in aquatic ecosystems. In the arid West, non-point source pollution is a major threat to water quality (Maret et al. 1987).

Mechanical restoration of incised stream channels can be expensive and labor-intensive, making natural restoration by beavers an attractive alternative (Baker and Hill 2003).

Sustainable beaver harvest management requires information on population parameters such as juvenile recruitment, sex ratios, age of sexual maturity, pregnancy rates, and litter size (Hill 1982). Management plans should be implemented on a watershed scale due to the beaver's ability to disperse along watercourses to reach available suitable habitat (Olson and Hubert 1994).

Control of damage caused by beavers is a common management concern. Removing beavers by either lethal or non-lethal means provides only short-term relief because the remaining beaver population can quickly grow and beavers are good dispersers.

Non-lethal damage control devices are emerging as the most effective long-term beaver damage control solution. These methods minimize impacts to beaver populations by allowing them to occupy suitable habitat, retaining the ecological benefits of beaver habitat modifications, while reducing or eliminating conflicts with human land uses. Beaver exclusion devices made of strong wire can prevent beavers from detecting flowing water that stimulates their dam-building response, preventing blocked culverts and irrigation structures (Munther 1983, Olson and Hubert 1994, Schulte and Müller-Schwarze 1999, Wilson and Ruff 1999). Water level control devices such as PVC pipe can be inserted into dams to limit flooding to acceptable levels (Lisle personal communication 2004). Wire mesh or decorative stone structures around desirable trees can prevent beaver cutting. Designs for these and other beaver control methods are provided by various conservation organizations (e.g., Beavers: Wetlands and Wildlife at http://www.beaversww.org/index.html). Jensen et al. (2001) describe devices for reducing beaver damage to roads from plugged culverts and flooding.

Beavers were severely reduced in the past due to human actions, and human attitudes about beavers remain a critical aspect of their conservation (Schulte personal communication 2006). Maintaining viable beaver populations and using beavers to promote ecosystem restoration require agency support and, sometimes, public cooperation, particularly when private lands and agricultural practices may be affected.